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EDITORIAL NOTES.

The Coal Position—Scottish Gas-Works Valuations.

THE chair at the "Informal Meeting" of Scottish Gas Managers was tenanted by Mr. D. Currie, of Airdrie; and he read an address of the one part on commercial matters which weigh heavily on the minds of gas managers at the present time, and of the other part on the perennial and vexed question of assessment for rating purposes, which, under Scottish practice, perhaps causes more heartburning to those concerned in large industrial enterprises than to those in England under English practice, open as this also is to much discontent and trouble. The current topic of coal supplies and prices came first in the address. More than sufficient for the day is the evil thereof to gas undertakings. Being large users of coal, the managers of gas undertakings were among the first to see the danger that threatened the industries of the country by the course of events; and we venture to claim that the other home industries owe something to the gas industry for what Mr. Currie describes as the prompt measures taken in making representation in high places as to the position and prospects in relation to coal. "You are fully aware," said Mr. Currie, "of the result of those influential representations." The result has so far been of a negative character, unless we can take partial credit for the appointment of the Board of Trade Coal Committee whose report was the subject of comment last week, and which report we hope will bear good fruit in defending private and industrial consumers in the country against those operations which have resulted in coal going abroad to neutral countries that was badly wanted at home, and which have caused prices to ascend to figures unwarranted by increased costs. Perhaps, too, the representations of the industry, and the part it is taking in the supply of the ingredients for the production of high explosives, had something to do in inducing Lord Kitchener to make his appeal to the miners to work longer time at Easter, and to which appeal in several coal areas there was hearty response—so hearty, in fact, that the miners have, through the Prime Minister, received an acknowledgment of the gratitude of the Government. But in other respects—save in the increase of the tonnage available for coal transport from the Tyne—the representations of the gas industry have not, we regret, had much effect in providing immediate relief.

The report of the Board of Trade Committee may, however, stir the Government into action; and, although we agree with Mr. Currie that the outlook is at the moment anything but favourable, gas undertakings will do well to stay their hands in making their new contracts until they see whether or not the Government will take steps to carry out the recommendations of the Committee. Whatever is done (if anything), it cannot have other than a good effect; so that a little delay in entering into contracts cannot do damage. But if the Government continue passive in the matters reported upon, and suffer recent and current conditions to prevail, the charge of want of patriotism in this regard will fairly lie against them; and then, too, private and industrial consumers will find the outlook dreary indeed, particularly such concerns as gas undertakings which have, through the ruling conditions, had to dig deeply into stocks and which have to more than make these good in order that there may not be failure next winter. This is an awkward state of things, because it has happened at an abnormal time—in fact, the large depletion of stocks now is a far worse occurrence than it was at the time of the national coal strike in 1912.

Passing from this matter to another touching coal, Mr. Currie is of opinion that the present is a most opportune time for considering the advisability or otherwise of introducing a standard coal specification and model form of conditions of contract for general use by gas undertakings. In our opinion there is quite enough trouble encompassing us now without attempting something that has not in times of tranquillity been taken in hand, and as to the feasibility of which there are grave doubts. We should like a clearer definition as to what Mr. Currie means by a standard coal specification, and perhaps he could offer something typical. Standard conditions of contract are understandable; so, too, are specifications for individual concerns; and a standard outline specification for general use might be possible. But a standard specification in detail which all concerns could adopt, with all the different qualities of coal that are used for gas-making, is something that exceeds the bounds of practical politics. No works, unless it has a full-scale test-plant, and can individually test the various classes of coal, could prepare a detailed specification of each, and see from time to time that the specification was being complied with. Perhaps this is more than Mr. Currie has in contemplation. But, if feasible, and if gas undertakings worked to one standard specification—that is, interpreting Mr. Currie's proposal in the broadest and fullest sense—we can well understand that the market price for standard gas coals would harden considerably. The best way to buy coal is to first test samples on, if possible, a working scale; and specify that the deliveries under the contract shall be up to the results of the test. Then examine the incoming coals at intervals, to see that they comply with the original test; if they do not, a penal clause should come into operation. "In times like these," said Mr. Currie, "when we are "expecting to pay exorbitant prices for coal, it is our duty "to see that we obtain value for our money." This duty has always existed under any conditions; but perhaps the responsibility is of a more imperative order when the prices of coal are high than when they are low. We know that recently and at the present time some miserable stuff has been and is finding its way to gas-works under coal contracts; but if means have not been provided for obtaining compensation, in the event of a falling-away from the quality of material contracted for, the fault for this rests with those who entered into the contract for not having secured the necessary provision. In passing, it may be mentioned that a standard specification for coal purchases was framed for use in the electricity supply industry. But that is another matter. It dealt with ash and moisture, and particularly with calorific value—providing for increases or decreases of contract price for coals showing a certain excess above the standard calorific value or reduction below it. But the standard specification has not been found by electrical engineers to be an unmixed blessing. For in some cases the coal has shown on test a calorific power that has caused an addition to the contract price—making the cost more than the engineers have calculated for, and yet the higher calorific value has not invariably found expression in the duty of their boilers. In the case of coal for steam-raising, other things besides calorific power should be taken into account. One coal may have a lower calorific value than another, and yet may be far more efficient in a steam-boiler.

Practical were Mr. Currie's remarks on the subject of residual products, which, with the exception of tar, have come well to the aid of the industry in a time of stress of unequalled severity, caused principally by coal. There is in the address recognition of the value of co-operation in connection with the development of coke and sulphate of ammonia sales; and Mr. Currie is found to be a staunch supporter of all-united effort in these directions. Development of these markets on the most economical and efficient lines lies in such systematic work as is done by the London Coke Sales Committee and the Sulphate of Ammonia Association and Committee, and which work must, of course, be supplemented by the cultivation of local demand. The war has been an advantage to the development of the home demand for coke and the stronger establishing of British sulphate of ammonia interests in distant parts. In both coke and sulphate of ammonia, what has now to be done is

to work to retain what has been gained, and to make the demand still stronger. After the war, coal will again come into strong competition with coke; and Germany will let loose her surplus—it is an ever-increasing surplus—of sulphate of ammonia. That is the period for which work has now to be done; but some people think only of the present, and not of the morrow, which is commercially a very bad characteristic.

The latter part of the Chairman's address was occupied with a grumble at the practice governing the valuation of gas undertakings in Scotland. There is always room for grumbling under this head by Scottish gas managers; for they are all subject—as is made clear by Mr. Currie—to practices in determining the assessments of undertakings which sadly lack uniformity, and are dependent largely on individual fancy. The instances he quotes of the different practices of the assessors appointed for the work in each county or burgh, and the differences in the results per cent. of capital, or per million cubic feet of gas made, in the case of non-profit earning undertakings, are proof of the need for revision and co-ordination. So long as the present disuniform conditions last and principles prevail which are unfair, so long will there be dissatisfaction and litigation. Those present at the meeting considered it was high time that some serious effort should be made to get relief from the iniquitous valuation system under which the Scotch concerns labour; and a Special Committee was appointed, at the instance of Mr. J. W. Napier, to go thoroughly into the whole subject. It is an excellently constituted Committee. It appears that the idea of its proposer is that it shall bring the subject before the North British Association when prepared with a report, in order that there may be some concerted and authoritative action in those quarters through which only effective result can come—such as the Secretary for Scotland. It is hoped the Committee will be successful in the work they are undertaking; for reform is urgently needed, and, in fact, it would only be a measure of long overdue justice.

Bolometric Method of Testing Radiant Efficiencies.

In the "Journal" for March 9, brief reference was made to the paper jointly presented to the Royal Society by Dr. W. A. Bone, F.R.S., Professor H. L. Callendar, F.R.S., and Mr. H. James Yates. As was then explained, the labours of the three collaborators have been directed to the devising of a bolometric method of measuring the radiant efficiencies of gas-fires and other incandescent bodies and surfaces. The previous brief allusion to the paper will have aroused a desire for the opportunity of perusing the complete contribution. This opportunity we are now in a position to give, as will be seen from other pages of to-day's "Journal." But there is one thing that those of our readers who have not had a laboratory training are asked to believe; and it is that the account of the scientific principles underlying the new instrument and its operation must not be taken as a contradiction of the claims to simplicity and to ready and accurate working. The new instrument is proposed in substitution for the radiometer-*cum*-thermopile device in the Leeds method, which, the authors admit, while agreeing that it is perfectly sound in principle, is open to various criticisms, principally in respect of the water-calorimeter radiometer used and the time expended in making a complete test. With the new bolometer, the radiation falling from the fire under test upon a blackened coil of platinum wire can be deduced from the observed increase in its electrical resistance; the area of the receiving coil being sufficiently small to allow of the instrument being standardized from a source of radiation of known intensity. It is explained that the principal object of employing the bolometer in place of the thermopile is to secure a greater range of accuracy and sensitiveness, and to facilitate the obtaining of automatic records when required. The sensitiveness is readily varied over a wide range by varying the electric current employed for measuring the resistance. In the construction, too, constancy has been aimed at rather than rapidity, such as Professor Langley obtained in the form of bolometer invented by him. But this rapidity was accompanied by extreme fragility, which is not an acceptable characteristic in an instrument to be exposed not only to the careful work of the scientist's laboratory, but to the rigours of the works' laboratory. The instrument, as previously remarked, is of small size, and light in weight, and it practically eliminates the personal factor. There are several matters discussed in the paper bearing upon principles and working; and the results of a series of bolometric readings are given. This short mention of the paper will suffice at the moment, as we hope to have the opportunity of again referring to the subject at an early date. The importance of the matter warrants this; for the scientific and practical value of securing in all respects reliable means of prosecuting such work as the measurement of radiant efficiencies—no matter the originating quarter of these means—must be obvious to all.

Carburetted Water-Gas Troubles and Cures.

Presidential addresses vary as widely in their composition as the limits of the matters which affect, even remotely, the interests and work of the gas industry; but of all addresses the ones that are most educative, and therefore valuable, are those from men who are specialists in some particular line, through daily supervision and study, and search for solutions of the problems which arise. A man who has special knowledge in this way does far better, when honoured by election to a presidential chair, to devote himself to an account of some of his experiences—difficulties may be, and solutions—than by wandering over a large range of subjects, and treating his audience to a number of platitudes concerning them. Mr. Samuel Carter is the President this year of the Manchester Juniors; and on Saturday last he delivered to them an Inaugural Address which will be highly serviceable to all carburetted water-gas makers. Mr. Carter is, so to speak, professionally immured at the Garston works of the Liverpool Gas Company; and, at these works, only carburetted water gas is produced. The consequence is that Mr. Carter has largely made special study of this form of manufacture, and his address deals with certain troubles that he has encountered, and tells just how they have been overcome.

Tar fog in carburetted water gas is an old bugbear of the gas maker; and the detrimental effect that it has upon the material in the first purifier—quickly rendering it inactive, throwing heavy pressure, and lowering illuminating power—naturally suggests that ordinary condensation is insufficient, and requires supplementing by some more effective means, so as to escape the trouble and loss due to the causes mentioned. Difficulty was experienced at Garston. Now the cooling of the gas there is effected progressively; being mainly accomplished by plain air-cooled condensers, augmented when necessary by a slow flow of cold water through primary tubular condensers. As an auxiliary to simple condensation, filters under vacuum rather than under pressure are preferred by Mr. Carter, because by this practice the gas is not unduly dried. But the preference is accompanied by this drawback: As soon as the gas passes the exhausters, the pressure is increased from (say) -7 to $+17$ inches, and a fresh portion of light fog is developed, sufficient to convert the separated sulphur in the oxide to the plastic state of semi-solution, which also causes inactivity and back-pressure. To deal with this, Mr. Carter designed the "Hurricane" tar-extractor, or tar-trap, the constructional details of which are outlined in the address, and were formerly described when the patent specification was issued in 1912. Separators of various types have been previously used; but, with his own particular form, Mr. Carter obtains excellent results, and by it is relieved from difficulty.

Another trouble carburetted water-gas manufacturers meet with is the accumulation of emulsion in the settling-tank. Mr. Carter is of opinion that these accumulations of emulsion are largely contributed to by the syphon liquor, if this is led in a haphazard manner into the tank. Seeing that the secondary tars are too light to offer much hope of themselves settling or separating to any appreciable extent, the deduction is a safe one. But the method that has been adopted for dealing with these tars is the matter of interest, and its simplicity will be an attraction, together with the held-out promise of being "eminently successful after a "trial of over two years." The two years' trial, we imagine, has given something beyond a "promise;" it has, indeed, afforded actual proof. This, there need be no question, is what Mr. Carter means. In the method, utilization is made of the primary tar, which is deposited in a dry or water-free state, for dehydrating the secondary tars. The delivery-pipe from the syphon-pumps discharges into a 12-inch vertical pipe (open at both ends), standing in the settling-tank with one end above the surface of the water, and the other within 10 inches of the bottom, or below the level of the tar

suction. What then happens to the emulsion is that the "atmosphere" of light tar is dissolved into the heavier tar, and the water globules are thus allowed to escape. So long as there is a supply of good tar in the bottom of the tank, the emulsion will be effectually treated, and indifferent tar reduced to an inconsiderable amount. The tar sold only contains from 1 to 2 per cent. of water.

What Mr. Carter describes as a "startling illustration" of the effect of a change of heat on the illuminating power of the gas and the quality of the tar produced, was an experience that perhaps would not have occurred had there been further prior consideration of the matter. It was merely that when the Liverpool Gas Company obtained relief from their high illuminating power standard, the quantity of oil to be cracked per run was reduced by a little more than one-half; and, in view of this, the heats were slightly reduced. This was the mistake, as for every grade of oil there is, as has been since found at Liverpool, only one right heat at which to crack and fix it so as to get good all-round results. The results of the reduction of temperature were that the illuminating power of the gas was not of an amount of which boast could be made, and the primary tar was not heavy enough to settle itself, much less to deal with the large quantity of light secondary tar. The method now followed is: The heat has again been raised; the oil is put in at the old rate, but for only half the time; and blue water gas is made during the rest of the run. This has been found efficacious both in regard to the quality of the gas and the behaviour of the tar. In this relation—the effect of temperature upon the working efficiency of a carburetted water-gas plant—there is further illustration in the troubles experienced through the improved ventilation of the purifier-house, and the consequent cooling of the purifiers, which began to act as condensers, affecting both the oxide and the illuminating power of the gas. The cure in this instance was the reduction to 60° of the temperature of the gas at the condenser outlets.

Towards the end of this useful address, attention was directed by Mr. Carter to what is being done at Liverpool in the matter of toluene recovery from gas; and there is here a point affecting practice which strikes one. It simply refers to the use of prebenzolized wash-oil or untreated wash-oil. Dr. Davidson uses the former in his system; the Gas Light and Coke Company find that, if they employ a "limited amount" of a suitable wash-oil, very little injury is done to the illuminating and calorific power of the gas—that is, by proportioning the quantity to the work to be done; Mr. Carter's experience is that treating coal gas and carburetted water gas (50 per cent. of each) with ordinary oil gas, resulted in serious depreciation of the illuminating power of the gas, and, to a slight extent, of the calorific power. With benzolized oil—oil containing 5·66 per cent. by volume of 90 per cent. benzol—the effects on the illuminating and calorific power were negligible. These varied experiences with wash-oils and results would make good subject-matter for investigation. Another point is as to whether the prebenzolized gas oil will as efficiently extract the toluene as did the oil untreated with benzol.

Bye-Product Coke-Ovens for Town Gas Supply.

One of the best reasoned contributions to the question of the policy of adopting bye-product coke-oven plants that has yet been made comes from Mr. J. D. Forrest, of the Citizens' Gas Company, of Indianapolis, which Company have had considerable experience of the system. After reading the paper, and having from the author a clear exposition of the case in favour of the introduction of bye-product coke-ovens into gas-works operation, and of an equally strong case against, one is left faced by the same old problem—there must be determination of the matter of adoption or otherwise under the individual conditions of every gas-works; and the conditions for consideration are many. In fact, the value of the paper (which was read before the Indiana Gas Association last month) lies in the marshalling of the various considerations, so that each gas engineer can look at the matter from all points of view. However, after perusing the paper, and getting one's views swayed to and fro, at the end one comes to Mr. Forrest's general conclusion from his Indianapolis experience. It is that, at the present time, the most economical known method of gas manufacture is the bye-product coke-oven, and that it is so economical that it should be employed wherever conditions justify it.

"Wherever conditions justify it!" What are these conditions? The important ones are really few. Outstanding is the essential of a field for the sale of metallurgical coke. But in this connection, the point should be made that it must be a field that is comparatively free—the greater the freedom the better—from proximity to existing large coke-oven plants; otherwise the competition might be disastrous to the gas-works coke-oven plant. Another point presented by the author is that bye-product coke-ovens should not be adopted by gas-works with less than an output of a million cubic feet per day. In Wales (at Ferndale) we have an illustration proving that local conditions may make suitable sized bye-product coke-ovens quite a feasible proposition for a works with even a lower daily output than a million cubic feet. Another necessary condition is that the works must be in a position to bear the extra capital expenditure (compared with retort-settings) involved in putting down coke-oven plant. Supplementing the favourable conditions are the advantages of the coke-oven. The author places foremost the economy of labour in relation to work done. Then comes the higher quality of the coke, which he says is suitable for all purposes, including domestic uses. As the experience at Birmingham proves, the operation of coke-oven plant designed for gas-works operation can be varied, so as to produce coke of, within limits, different density. Nevertheless in this country, where central-heating stoves are not commonly employed for domestic purposes, but the open grate is the fashion, Mr. Forrest's statement as to applicability of oven coke to domestic purposes requires some qualification. The conditions here are not precisely on all-fours with those with which our American friends have to deal. Another point is that the considerable percentage of water gas supplied in that country largely relieves the gas-works from what has been, under normal conditions, a growing difficulty in this country—that is, the disposal of the large amount of retort-coke produced. Therefore, where the conditions are favourable for the production and disposal of metallurgical coke by gas-works in this country, there, by so doing, the retort coke market would find relief; in other words, the ability to supply a larger coke market is conferred by the coke-oven, and is an advantage if the limits of the market embrace foundry work. Other benefits listed by Mr. Forrest are that fuel requirements are more economical than in the case of ordinary retort-working, and that the quality and quantity of the bye-products are higher.

As to the gas, a point is made by the author about the calorific value of the coke-oven production. In one of the Indianapolis plants, the fore part of the gas made is separated from the latter part; and Mr. Forrest appears to pride himself upon the fact that from this plant the average calorific value of the gas made for town supply during 1914 was 630 B.Th.U. In another plant, the gas from which is not separated, it is "very difficult," he says, to get the average heating value up to 600 B.Th.U.; but last year it averaged 599·27 B.Th.U.—a difference of only about 5 per cent. compared with the separated gas from the other plant. It would be interesting to have a balance-sheet of the net cost into the holder of the gas from these two plants. There seems to be a large amount of regret surrounding the two words "very difficult;" but we cannot see why, from the practical point of view, there should be any regret whatever over the difference of 5 per cent. in calorific value. As a matter of fact, our opinion is that the difference is not a disadvantage to the gas consumers. High calorific power suggests a constitution of gas that requires a considerable proportion of air to secure in bunsen burners perfect combustion; and the larger the proportion of inert constituents introduced, the larger the amount of heat that will take flight with the products of combustion from useful service. We have not seen the results of any study by our American friends of this question of the right calorific power of gas from the point of view of the working efficiency of the appliances used for domestic purposes. In this country, gas having a calorific power of 500 to 540 B.Th.U. gross is found good enough for all purposes.

Coming to the disadvantages of coke-ovens for gas-works purposes, no one would think of adopting such plants other than to the extent that there is a market for the special class of coke produced. This is the dominating condition. The higher capital expenditure is also, as Mr. Forrest points out, a serious matter; but we are afraid that some people (we do not include the author of the paper) make comparisons of capital expenditure on carbonizing plant without taking the economic aspects into full account.

Paying economy may be purchased by extra capital investment. Coke-ovens, with the auxiliary plant required for their operation, must necessarily—owing to the heavy weights of material that have to be handled—be more expensive than ordinary retort-house plant; but if there is a material advantage in reduced labour costs, if a fresh profitable market can be opened-up for coke, these are conditions that are worth additional capital expenditure—within limits. An eye has to kept on both working expenses and the profit to be made from residual products in considering the question of capital expenditure. The day has long past when capital outlay per million cubic feet of gas made (or any other unit) is the sole factor—important though it be—in determining advisability. The profit that can be made on the capital, and the price at which gas can be sold, have also to be taken into account; and the Citizens' Gas Company of Indianapolis are to be congratulated on the price at which gas is sold by them, under their conditions, compared with many other American gas undertakings. "If I had the "whole history to live over again," says Mr. Forrest, "I "should still consider it the only method by which the Com- "pany could have been made a success. I have no regrets "because of our choice." But the whole paper breathes caution and urges discrimination, not only in regard to the points mentioned here, but as to others.

There is one more matter. It is the advice of Mr. Forrest that, owing to the diverse character of the two industries—the bye-product coking industry and the gas-supply industry—gas undertakings in proximity to existing coke-ovens should purchase gas from them rather than erect coke-ovens on their own account. This is diplomatic counsel. In the neighbourhood of established coke-ovens, as we have said, disaster could only come to gas works that tried to enter into competition with large-scale producing competitors for local custom for metallurgical coke. There is no need to make a double mess in this way. Middlesbrough has entered into business relations with the owners of coke-oven plant for a supply of gas on paying terms; and other corporations are in Parliament this year asking powers to do likewise. Of course, the price of the coke-oven gas must be reasonable, or gas-works cannot entertain such business relations. As Mr. Forrest also advocates, purchase must be to the extent of only a proportion of the total requirements. Coke-oven owners have no statutory obligation in regard to the supply of gas for town use; while the statutory obligation rests upon gas undertakings to maintain a supply to the communities served. Strikes of coal miners, if prolonged, would close-down many coke-oven plants at the pit-heads; and the duty would rest upon gas undertakings to be prepared for all such emergencies. This being so, considerable care must be exercised in this matter. We know the quality of coke-oven gas can now be relied upon; we know, too, there are coke-plant owners willing to enter into contracts, subject to conditions, at an inviting price. But still plant—old carbonizing plant or water-gas plant—and materials must be kept in reserve at the gas-works, as a precaution against uncomfortable eventualities. The old reserve over works' production would not do; there must be a margin sufficient to also cover any cessation of supply from the externally owned coke-oven plant.

The Message of the Advertisement.

It is not often there is occasion to criticize the form of the advertisement matter issued by the British Commercial Gas Association; but it is felt there is room for so doing in regard to the drafting of the "Munitions" advertisement which occupied the whole of the front page of the "Daily Mail" last Friday. In our opinion, the subject-matter of an advertisement should be made to (using a common, but not elegant, phrase) "hit one in the eye," as is invariably done by such advertisements as "Pears Soap," "Quaker Oats," "Beecham's Pills," "Kutnow's Powder," certain forms of car tyres, and so on. We are not in favour of the form of advertisement which covers the real message until one reads (if one cares to) the advertisement from top to bottom. In this particular advertisement of the B.C.G.A., the striking words are: "The problem is Munitions, more Munitions, always more Munitions"—Sir John French's celebrated words which have had world-wide circulation, and which every newspaper reader has now met with so often that their repetition to-day is enough to cause him or her to pass over the small type of the advertisement, while fully sympathizing with the cry of Sir John. In the centre of the page appears, also in eye-arresting type, the word "Shells," thrice repeated. Then follows in small type a supposititious conversation over the telephone between a manufacturer and a gas manager, in the course of which the former learns from the latter that gas-furnaces are the very thing for the rapid production of guns and ammunition of all descriptions. Only those who take the trouble to read down the small-type part of the advertisement are informed that it has anything to do with gas-furnaces, and that such furnaces are useful in munitions production. On one side of the printed matter is a sketch—and an indifferent sketch, too—showing the loading of cases of ammunition (they might be cases of anything else) on board ship, and on the other side there is a scene from the battle-field.

Preference and Example.

We should have preferred to have had some large type eye-arresting words at the top of the advertisement, such as: "Gas-Furnaces and Rapid Production of Munitions;" and, instead of the sketch showing a number of men handling ordinary looking boxes, we should have liked to see one illustrating part of a gas-works, and on the other side the scene on the battle-field, with the words at the top "From Gas-Works to Battle-Field." This is a case in which "Gas-Furnaces" could and should have had equal prominence with "Munitions." We want to see gas kept conspicuously on top, and not covered up by something else, as though its utility was of secondary importance. There is no occasion for this. The gas industry is doing an immense amount of work in connection with the war; and the public are absolutely ignorant of it. Good use should therefore be made of the public channels of information to make known the indispensability, in more ways than one, of our industry in the great struggle. A day later on the first page of the "Daily Mail" there was one of the best advertisements ever conceived. It could not fail to "hit in the eye" every reader of the paper, and to inform him in three words that "Zog cleans paint." If, too, the vacant parts of the page and the small illustration were truthful, these well exemplified how effectually "Zog" does the work. Then another page of the "Daily Mail" the same day was occupied by an advertisement the eye-hitting words of which were "Sulphate of Ammonia," and there was some excellent pictorial work accompanying it. This advertisement emanated from the Sulphate of Ammonia Association. With its Munitions advertisement we think the B.C.G.A. hopelessly failed to secure a bull's-eye, which is an exception to their rule.

Cornered.

The editorial article of the "Iron and Coal Trades Review" on the report of the Board of Trade Coal Committee is a curious piece of work; and it will not do much (if anything) to remove the gravity for the coal industry of the condemnatory character of the report in relation both to coal prices during the present national emergency, and to the conditions which commonly rule in the conduct of the coal business. It is quite obvious from the character of the comments of our contemporary that it found considerable difficulty in dealing with the situation. Of course, the point is made that there was no representative of the coal trade on the Committee; and though large buyers, coal merchants, and colliery owners (without mentioning representatives of other interests) gave evidence before the Committee, the "Review" naturally says "its pronouncements perhaps cannot be regarded as very authoritative." "Perhaps" happens to be a useful word in this connection. It is interesting to have the opinion of our contemporary that the report contains "comparatively few mistakes in regard to matters of fact." When statements are "matters of fact," they cannot be classified as "mistakes." But in regard to most of the salient matters put forward in the report, the "Review" later endeavours to show that they are "mistakes"—in fact, in dealing with the details, it finds little to support its first conclusion in regard to the document as a whole. Then the recommendations of the Committee, if they show no particular ingenuity or originality, are "far less fantastic and preposterous" than many that have been put forward. In fact, the "sobriety of the recommendations and of the language of the report generally, will probably disappoint the expectations of those demagogues who, knowing little or nothing of their subject, have raved wildly of exploitation, extortion, and blackmail, and almost in the same breath urged their own followers to make

the most of the situation in every way." The "sobriety" of the recommendations is not revealed in the attack made upon them by the "Review," which only seems to see good in the proposals bearing upon the reduction of freight rates on interned ships and the use for coal transport of further enemy ships. The "sobriety" of the recommendations will probably have very good effect when the subject comes before Parliament. The report, it also appears, "contains much contentious matter, and includes proposals which the coal industry cannot regard as either necessary or wise." That is not surprising.

The "Usual Desire."

The "Review" defends the sliding-scale system, under which some of the leading coal merchants in conclave put up the price of coal, and hand to the coal owners half of all they can make by way of increase, and the owners add to the pithead price an amount equal to half the addition to the retail price. There can be "no common interest in high prices," says our contemporary, "except the usual desire of traders to get the best possible price for their commodity, which is not generally accounted a crime." This "desire" has a very strong hold on the coal industry; and, unlike most other traders, the coal industry is in a particularly good position, by conference and agreement, for inflicting the "best possible price," and it has made extraordinarily good use of its power during the national crisis. Of this the "Review" is as well aware as we are. It is also equally cognizant of the fact that some colliery owners have been guilty of making short deliveries under contracts in order to have more coal to dispose of in the open market at the "best possible price" of the day. The "Review" is happy over the fact that "the Committee have come to the sensible conclusion that the rise in the price of house coal is not attributable to the existence of rings;" but it exercises great discretion in omitting reference to the statement as to "opportunities of conference among those chiefly concerned, which do, in effect, commonly lead to concerted action with respect to prices."

Objections.

Again, our contemporary does not think that 3s. per ton is a fair estimate of the increased costs of coal production and distribution. Other men besides the Committee have made similar estimates; and anyway there is a big margin between the 3s. and the actual increase in selling prices. A wonderfully sagacious remark is found in this connection. It is this: "It has yet to be shown, and the Committee has not attempted to show, that any section of the public has really suffered as a result of the advance in the cost of house coal; for employment is plentiful, and wages are high generally." The Committee were not appointed for the purpose of relieving the mental density of individuals. Wages in the poorer sections of the community have not risen with the same leaps and bounds that the prices of house coal have done; and the coal merchants and the coal owners between them have done their best to crib as much of the war bonus as possible that employers have granted to their hard-pressed workpeople. The recommendation as to the cessation of exports to neutral countries is a matter that our contemporary feels requires "grave consideration." While this country requires coal and can absorb it, there is no great need for "grave consideration." It also sees "grave objection" to the Government assuming control of the output of collieries during the continuance of the war. Our views on this point were stated last week. Further, it "doubts whether there are any excessive profits in the coal industry to limit." Of course it does; but it is not silly enough to say that there are not. We are at war; and the coal industry has not lightened the burdens of the country, because of "the usual desire" on its part "to get the best possible price" for its commodity. In doing this, the coal owners and merchants have not hesitated to take advantage of the national emergency; and this the "Review" cannot deny.

Aspects of Co-Partnership.

Turning over back numbers of the "JOURNAL," it is noticed that almost exactly a year ago there was a report published of a meeting at the London Chamber of Commerce, which was held to enable Mr. James Hope, M.P., to explain to the members the provisions of a Bill just introduced into Parliament by him [he introduced it in three successive sessions] to promote the adoption of co-partnership by statutory and other companies. So far as limited liability companies were concerned, the effect of the Bill—which never got beyond a first reading—would have been purely permissive; but with regard to statutory undertakings, there was what he termed "contingent and qualified compulsion." The basic idea of the scheme was that there should be a standard return for capital and a standard wage for labour; and when these had been secured, there should be a division of the remaining profits. The standard rate of dividend was to be 5 per cent.; and for every 1 per cent. beyond this rate, there was to be paid a proportionate bonus to the workmen. The struggle for self-preservation into which the country has since then been drawn, has for the time being pushed this and many other social questions far into the background. But now Mr. Hope has himself been led to call attention once again to the matter, by the statement of Lord Kitchener, in connection with the production of munitions of war, that the profits of the manufacturers would be shared in some proportion by their men. In the course of a letter to the "Daily Mail," Mr. Hope points out that, in other words, what was announced was "the adoption for the emergency of a system of practical and compulsory co-partnership." He admits that his Bill was largely inspired by the success of the South Metropolitan and other gas companies on similar, though not identical, lines; and that his faith in co-partnership is still as strong as ever it was, is shown by a renewed expression of his conviction that "the way out of labour troubles is to be found in a division of rewards, whereby the true underlying community of interest between Capital and Labour may be made visible, proportionate, and automatic." With this view we are in full accord; and it will, as Mr. Hope adds, "be a strange and ironical, but most blessed, outcome of the war, which cleanses and builds-up while it destroys, if, through the precedent set by a patriotic military organizer, the way of industrial peace may be prepared."

Trading with the Enemy Legislation.

The work transacted in the department of the Public Trustee is of continually increasing dimensions, in the ordinary course of things; but the seventh report, just issued, contains, in addition to the usual progressive statistics, particulars with regard to an altogether new task which the war has caused to be placed upon this useful official. Briefly, the Public Trustee has been, under the terms of the "trading with the enemy legislation," appointed Custodian of Enemy Property for England and Wales. Such property has to be registered with the Custodian, and certain important categories of enemy income are to be paid over to him The Act is not, however, in either respect completely comprehensive, inasmuch as some classes of enemy property are not registerable with the Custodian, and some classes of enemy income are not receivable by him. But, incomplete as they may be, the figures quoted in the report are exceedingly informative. It appears that at March 31 the enemy income that had been received amounted to £701,276; while the enemy property registered had reached the big total of £84,600,000. The last-named item is divided up as follows: Property held on behalf of enemies, £54,000,000; enemy capital in partnerships and businesses, £1,600,000; enemy capital in companies, £29,000,000. From the interest on money paid over under the Act, expenses of administration are to be provided; and some consolation may be derived from noting that "it has become manifest that the administration of the Statute will be carried out free of cost to the taxpayer, from the interest earned." Under other legislation, the Public Trustee has also been appointed to receive royalties in respect of patents avoided or suspended. It is pointed out that the policy has not been to destroy or confiscate the patent rights or registered designs owned by alien enemies; but merely to suspend them for the duration of the war in favour of British licensees—the royalties to be held in trust, and subsequently dealt with as the Board of Trade may direct. Up to the date of the report, some 65 licences had in this way been granted, the royalties in respect of which are payable to the Public Trustee.

The ninth annual convention of the Illuminating Engineering Society of America is to be held next week (Tuesday to Friday) at Washington, D.C. Mr. E. S. Marlow, of the Potomac Electric Power Company, is Chairman of the Convention Committee. The list of papers, &c., to be submitted at the meeting has not so far been received.

ELECTRICITY SUPPLY MEMORANDA.

THE other day one of our electrical contemporaries was cock-a-hoop over what was claimed to be a fact, that the increases in the price of electric current were insignificant compared with the advances in the price of gas. The increases that are being made by the electricity purveyors vary greatly. We have seen 1d. and ½d. per unit spoken of for lighting, and other figures for other purposes. But our friend, who was making an attempt to show (and it should be the truth under the circumstance of the special cause for an increase at this particular juncture) that the advance was lower in proportion in the case of electricity than in that of gas, had in mind electricity concerns that have only raised their charges by ¼d. per unit, and those that are adding 10 per cent. to consumers' accounts. The claim was made without due consideration. The basis was not stated on which calculation (if any) was made in order to form judgment as to whether the ¼d. or the 10 per cent. was the equivalent (say) of a rise of 6d. in the price of gas. We know that the metallic filament lamps photometrically test-out to about 1 candle per 1·5 watts, which is, in round figures, equivalent to 650 candle-hours per unit. If the generally claimed efficiency of 1 candle per 1·25 watts was true, this would represent 800-candle hours per unit. Photometrically, a properly regulated inverted gas-burner will give an efficiency of 20 to 25 candles per cubic foot of gas, which is equivalent (taking the lower figure) to 20,000 candle-hours per 1000 cubic feet. To attain this large total, upwards of 30 units of electricity would have to be consumed, taking the lower figure of 650 candle-hours per unit, or 25 units taking the higher figure. A farthing per unit on 30 units would be 7½d.; 10 per cent. on 30 units at 4d. per unit would be 1s. A farthing per unit on 25 units would be 6¼d.; 10 per cent. on 25 units at 4d. per unit would be 10d. In B.Th.U., electricity is altogether out of the running with gas; so that there is a big price margin there on the side of the latter. If the units were equal on which purchase is made of the two forms of supply, the users would then quickly see that, in relation to lighting value, there is not much difference between the lowest increase that the electrical people have had to make in price and the highest increase that has been made in the case of gas supply. Yet one electrical writer, without diving below the surface to see what the ¼d. and the 10 per cent. mean, says "electricity has not been dealt the rude blow that the gas concerns are staggering under."

Comparisons of Price Increases.

Reference has been made in the preceding paragraph to increases of ¼d. per unit, or an all-round increase on accounts of 10 per cent. This is what the majority of the London electric supply companies have collectively agreed upon; a few outstanding in order to deal with the matter individually. The Charing Cross (West-end and City) Electric Supply Company have notified a 10 per cent. advance in their power rates; while the City of London Electric Lighting Company have announced that electricity supplied for lighting purposes will be charged for in accordance with the existing sliding-scale—the alternative fixed rates for general lighting supply being withdrawn. The sliding-scale is 5d. per unit for the first six units per 30 watts of connected demand in each quarter; and 2d. per unit for all energy consumed in excess of such quantity per quarter. Intruding upon the prerogative of the ladies, the Dublin Corporation Electricity Committee have changed their minds two or three times in regard to the amount by which the price of electricity shall be raised. First the Committee thought that ½d. per unit for current used for lighting and ¼d. for that consumed for power would suffice. Then, to be on the safe side, these figures were doubled; and now, on a further review of the estimates, the Committee have returned to the original ½d. and ¼d. The Pembroke (Ireland) Electricity Committee have increased the price by 1d. per unit for private lighting, and, it is reported, have decided to charge 4d. per unit for cooking and heating. The last-named figure for "cooking and heating" must surely be a joke. These again are only sample increases. Poplar is proposing to make itself conspicuous by a reduction of price just at the time when most other electricity undertakings are forced to supplement revenue, or at any rate are, with unknown conditions buried in the future, maintaining the lines of present revenue. But Poplar is one of those fortunate places that has an extraordinarily fine industrial demand, and of this only the few and not the many can boast. A Joint Sub-Committee of the Finance and Electricity Committee of the Borough Council have approved of a recommendation of the last-named Committee that the price of private lighting shall be reduced as follows: From 5d. and 4d. to a flat-rate of 3d. per unit net (the present rate is equal to a flat-rate of 4d.). For long-hour consumers: From 2½d. to 2d. per unit net. Domestic consumers: From 12½ per cent. on installation expenditure to 8½ per cent.; and standing charge, from £4 per kilowatt to £3 per kilowatt for general lighting.

Increases and a Decrease.

The Poplar Council have not so far as we have heard yet agreed to the foregoing recommendation, nor have they to another one bearing upon the vexed question of the allocation of profits from trading undertakings, such as gas and electricity supply. The matter of the righteousness or otherwise of appropriating profits in aid of the rates has been discussed so often that we will not reopen it now to any length. Our views are well known. There should be no transfer of profits from such undertakings in aid of the rates; such transfer means unequal contribution to the expenditure on local government; any succour received by an undertaking from the rates should be repaid as early as possible; and each concern should have its finances so ordered that its income should balance expenditure. But if there cannot be an escape from a transfer of profits, then it should only be a small percentage on outstanding capital. The Poplar Electricity Committee want to have profit disposal once for all strictly defined, and the rule established. To this end, a scheme has now been proposed by them, with the assistance of their Engineer (Mr. J. Horace Bowden); and it is worth reproducing. Briefly put, it contemplates that—after providing for the cost of minor improvements to buildings and plant, meters and services, wiring and cooking installations, show-room and test-room fixtures, instruments and tools, office furniture, reclaiming of cable, removing and re-erection of machinery, sundry minor expenses connected with capital work, writing-down of service and instrument loans—the floating balance, as set out in the annual balance-sheet, shall be at least equal to 10 per cent. of the total income in any year. Of the remaining balance, 40 per cent. shall be devoted to relief of the rates, 40 per cent. placed to the credit of machinery capital account to provide for obsolescence of plant, and 20 per cent. divided among the workmen and staff of the undertaking in the following proportion: 5 per cent. to the Chief Engineer and Manager, 2½ per cent. to the Assistant Manager, 2½ per cent. in equal proportions to the station and mains engineers and sales manager, and 10 per cent. to the junior officers and workmen on the permanent staff in the generating and distributing departments *pro ratâ* to the salaries and wages paid in the year in which the bonus is earned, until a sum of £1200 is thus available for disposal. On any further amount, the percentage of bonus will be reduced one-half. The Joint Sub-Committee have expressed the opinion that the proposals are financially sound, as no matter how rapidly the undertaking develops, the cost of new connections and all improvements to the existing system must be taken from revenue before any sum is available for bonus. We shall be interested in learning the decision of the Council in regard to this proposal; and, if adopted, in ascertaining from time to time how the scheme is working. For the current year, the allocation of profits is to be separately dealt with.

Allocation of Profits—The Workers' Share.

There has been under discussion lately the question as to whether photographers should be allowed to have current for photo-printing purposes at power rates, or whether the charge should be at the lighting rate. There is a lot packed away under "power" that has no title to the designation, as generally interpreted. But while it is the custom to include in "power" industrial applications of many descriptions, we cannot for the life of us see why the use of electricity for photo-printing in the case of the work being carried on as a business should not be regarded as a trade purpose, although it is difficult to imagine that local photographers in small towns would be very profitable customers for this particular "trade" service at a low price. The fact that the current is used in a lamp does not alter the fact that it is a manufacturing process; and the general opinion seems to be towards this way of thinking, though there are a few dissentients. But this very matter has raised the subject of "undue preference" at Ilkeston. It seems that one photographer has been enjoying the use of current for printing at low rates, while another photographer—a Mr. Attenborough—has been paying on lighting rates. This is very wrong. The two supplies are "corresponding" ones; and there must be no "undue preference." Mr. Attenborough claimed his right to treatment equal to that meted out to his competitor in trade; but there was some reticence to comply on the part of the Electricity Committee. The claimant, however, very properly took sharp measures to bring the Committee to their senses. He informed the Town Clerk that, if within forty-eight hours the Council did not agree to supply him at the same rate as his trade rival, he would enter an action against the Corporation for "undue preference." That did it. A special meeting of the Committee was hurriedly convened; and they not only promised to supply Mr. Attenborough at the same rate as his trade competitor, but they refunded £2 9s. 8d. in respect of accounts which he has recently settled. The illegality of "undue preference" wants to be noised abroad, so that those whose pockets are concerned may watch over their own interests. If all electric power users only knew what other power users in the same area of supply were paying, and were aware of the parliamentary principle as to equality of charge for "corresponding" supplies, there would be a pretty kettle of fish to look after.

Photographers and "Undue Preference."

With much modification of the scheme—notably by the annihilation of the hiring-out powers—the Glasgow Corporation and the Electrical Contractors' Association of Scotland have come to an agreement as to what shall and what shall not be done at the new electricity showroom of the former. There has been a good deal of snarling over the renunciation by the Corporation of the hiring-out proposals; and

Contractors and Corporation Agree.

writers have urged that this was the one thing needful to make domestic electrical operation move forward with greater rapidity than hitherto. This is a very ridiculous suggestion, if there was any truth in the savings, conveniences, and much else that used to be paraded as the virtues of the use of electricity in the house, to say nothing of the charm of having to pay heavy quarterly hiring rates and maintenance costs, and having extra variety put into existence by cooker breakdowns and occasional shocks administered to the cook by the innocent-looking but bad-tempered creation. "See what gas is doing," say certain of the critics; "low hiring-rates, and in some cases cooker-fixing free." Just so; and a good profit is made out of the gas used, seeing that it is charged for at lighting rates, and not at the low rates considered necessary by the electrical people, and which, though low, are still incapable of beating gas for all culinary requirements. However, the Glasgow electrical contractors will not agree to the Corporation Electrical Department exercising hiring powers; but they have kindly agreed to a scheme, to run for five years, under which the Corporation are to be allowed to equip and manage a showroom through which the contractors are hopeful of adding to their own revenue. Among other conditions, the contractors have arranged that they and their customers shall be afforded all possible facilities for inspecting stock there; that any electrical contractor who shall "request" the Corporation to sell any fittings, accessories, lamps, or apparatus shall be entitled to receive one-half of the discount which he would have received from the makers, had he sold the apparatus direct; that all fittings, accessories, lamps, and apparatus sold from the showroom shall be at the current list prices of the firms supplying the goods; that, as far as possible, sales initiated in the showroom shall be completed through the contractor who sent the customer; that all wiring work resulting from inquiries at the showroom shall be done direct by a contractor, and no undue preference shall be shown. In other words, the showroom, run at the expense of the Corporation, is a business-making concern for the electrical contractors; the Electricity Department will gain from any additional electricity sold, through the development of the use of apparatus in consequence of the existence of the showroom.

Boiling Discs v. Self-Contained Appliances.

As was seen in our issue last week, Mr. H. Purle was condemning electric boiling discs as wasteful things, and abominations in the sight of every householder who has been foolish enough to adopt them. The contributor of "Cooking and Heating Notes" to the "Electrical Times" agrees that present disc designs are far from ideal. If they are of the enclosed "ironclad" type, their efficiency is low, and the life of the elements uncertain. These must be run at temperatures much in excess of those needed for the work they are called upon to perform; while the loading per square inch of plate must be kept down in order to guard against overheating and internal short-circuit. If the element be of the radiant exposed type, higher efficiency and longer life are secured at the expense of troubles that do not arise with the enclosed form. The heating unit is more or less unprotected, and is therefore liable to mechanical damage. It is subject to failure through contact with spilt grease and liquids, while the risk of shock is greater than with the enclosed form. Mr. Purle advocated the use of self-contained cooking apparatus, on the ground that its efficiency is higher; but, as the writer points out, efficiency is not the only factor to be considered. Convenience and simplicity are of equal importance, and in the ordinary household count for a great deal. The first cost of self-contained utensils is very heavy; and a complete range—comprising kettles, saucepans, fry-pans, steamers, stewpans, and the like, such as are required in all households, would bring up the cost of a cooking installation to a prohibitive figure. Flexibles, too, the writer abhors. He also finds self-contained appliances are not easy to clean. There we have experts condemning both electric boiling-discs and self-contained appliances. In the circumstances, what is the householder to do but to stick to gas, or turn from a coal-heated range to a gas-heated one?

Oversight.

We should like to call the attention of Mr. R. Weaving, of Ferranti's Limited, to the fact that he has not replied to the editorial note appended to his letter in our issue of the 16th ult. This, of course, is a pure oversight on his part; but, in case he has forgotten the circumstance of having questioned the accuracy of certain criticisms of ours, we may remind him that the letter he wrote to us appeared in our columns under the heading "'Silly Theory' on Gas-Fire Heating."

Unit of Candle Power in White Light.—This was the title of a paper by Messrs. C. C. Paterson and B. P. Dudding which was read by the latter at a recent meeting of the Physical Society. The authors gave an account of the methods adopted at the National Physical Laboratory for minimizing the difficulty of photometric comparison of white lights of different hue. A series of six sets of electric sub-standards were described, varying in the tint of the light radiated from that of the pentane lamp to that of a tungsten vacuum lamp operating at 1·5 watts per candle. The absolute value of the unit of candle power has been re-determined, as have also the corrections for humidity and barometric changes; while the probable existence of a temperature correction was discussed.

PERSONAL.

At the meeting of the Carnoustie Town Council on Monday last week, Mr. JOHN IRELAND, of Moffat, was unanimously selected, out of 35 applicants, to fill the position of Gas Engineer and Manager to the Corporation.

The wedding took place at Oldbury, last Thursday, of Mr. GRAEME ROSS MORGAN, the Assistant Gas Engineer at Oldbury, to Miss WINIFRED MARY SHAW, of Oldbury. The presents included a case of fish knives and forks from the management, office staff, and outdoor staff of the Oldbury Gas Department.

The minutes of the Gas Committee which were adopted at last week's meeting of the Lincoln City Council stated that the Gas Committee had resolved that Mr. W. H. MAINWARING, the Superintendent of the gas-works, be appointed, until further notice, Temporary Manager of the undertaking, in place of the late Mr. John Carter.

Mr. H. PRESTON, the oldest Director of the York Gas Company, celebrated his 100th anniversary last Thursday, having been born on April 8, 1815, at the village of Easingwold, near York. Mr. Preston is highly respected in the city, of which he is the oldest freeman. He is in comparatively good health, though at present confined to the house. His wife died last year, at the age of 94.

To fill the vacancy as Works-Manager at the Central Gas-Works, Oldham, rendered vacant by Mr. RUDOLPH H. DUXBURY having been appointed Assistant-Engineer for the new works which are shortly to be erected at Longwood, near Huddersfield, Mr. J. W. DIXON has been promoted from the Hollinwood Gas-Works to the Central works; and Mr. H. WRIGLEY from the Higginshaw works has been transferred to Hollinwood. The filling of the vacancy at Higginshaw is left over for the present.

The Helensburgh Town Council have unanimously appointed Mr. DAVID FULTON, at present the Assistant-Manager at the Helensburgh Gas-Works, as successor to the late Mr. William Blair, the Gas Engineer and Manager to the Corporation. Mr. Fulton was a very successful student in "Gas Manufacture" in the Glasgow Technical College, and is a prominent member of the Western District Division of the Scottish Junior Gas Association, of which he was the Secretary and is now the Vice-President. It may be remembered that at a recent meeting he read a paper on the subject of the vertical retort installation at Helensburgh.

The Manchester Corporation last Wednesday appointed Mr. L. HOLME LEWIS as Engineer to the Water-Works Department, at a salary of £850 per annum. The Chairman of the Water Committee (Alderman Holt) explained that Mr. Lewis had been in the service of the Committee for twenty years, during which time he had had entire control of the hydraulic power department, which had been very successful. He was not a water engineer; but he had shown himself to be competent to carry out any work entrusted to him. In making the appointment, the Committee were not changing in any way the arrangements with Messrs. Geo. Hill and Sons, their Consulting Engineers.

OBITUARY.

The death occurred recently at Bridlington, at the age of seventy-seven, of Mr. JOHN C. ARCHER, who was for many years Secretary of the Bridlington Gas Company.

A link with the commercial life of Stowmarket has just been severed by the death, in his seventy-third year, of Mr. WILLIAM OLIVER BARBROOK. From his boyhood he had been connected with the firm of Messrs. Thomas Prentice and Co., Limited, malsters and merchants; and at the time of his death he held the position of Managing-Director. The firm were connected with the local gas-works till they passed into the hands of the Stowmarket Gaslight and Coke Company, and Mr. Barbrook became the lessee. He was an excellent man of business, and took great interest in this branch of his labours.

The name of Major SAMUEL FLOOD-PAGE will be remembered by many of our readers from his connection with the Crystal Palace, as Manager, about the time of the Gas and Electric Exhibition in 1882-3. His death last Wednesday, at the age of eighty-two, therefore calls for record. He was gazetted to the 2nd Madras Light Infantry in 1855, and retired in 1873 with the rank of Major. He then became Manager of the Crystal Palace, but relinquished the position to devote his energies to promoting the commercial utilization of the electric light. As General Manager of Edison's Indian and Colonial Electrical Company, he visited Australia in order to introduce the incandescent lamp in that country; and on his return in 1883 he was appointed Secretary and Manager of the Edison and Swan United Electric Lighting Company—a position he retained till 1892, when he became a Director.

The death last Thursday, at his residence, Flixton Hall, Bungay, of Sir FREDERICK EDWARD SHAFTO ADAIR, Bart., calls for notice in the "JOURNAL" from the association (carefully concealed for some years) of the deceased with the Metropolitan Water Supply. Sir Frederick, who was born in 1860, was holder

for life of the "King's Clogg"—a rent-charge and annuity of £400 a year, which from its creation in the reign of Charles I. till 1905 was paid by the New River Company to him and his predecessors in title. It was assigned by William III. to Dennis Cooling, and in course of time passed to Sir Frederick Adair. His right to receive the annuity from the Metropolitan Water Board was confirmed in an action tried before Mr. Justice Warrington in 1908, and subsequently upheld in the Court of Appeal. Sir Frederick was unmarried, and is succeeded by his brother, Mr. Robert Shafto Adair, who is a Director of the Brentford Gas Company.

THE GERMAN GAS INDUSTRY IN WAR TIME.

Communicated to the "Journal für Gasbeleuchtung" by the Deutsche Continental Gas Company, of Dessau.

For a good many years past the gas industry has been steadily developing, both in Germany and everywhere abroad. It is true that for something like the last thirty years, it has no longer had the monopoly for the supply of towns and communes with light, heat, and power—having lost this privileged position in consequence of the appearance of its competitor, electricity. Moreover, the gas industry has frequently suffered severely owing to social legislation, such as the introduction of Sunday rest and earlier closing hours for business houses, as well as owing to the introduction of Mid-European time and the invention of suction gas and Diesel motors. Nevertheless, notwithstanding all these set-backs, the gas industry soon recovered, and has increased in importance by methodical expansion in old spheres of activity, and the opening-up of fresh areas of supply. At any rate, it does not feel anything of that decrepitude which it is frequently alleged to experience. On the contrary, during the last ten years, it has progressed on territory in which, according to public opinion, it had been forestalled by electricity. The gas industry has also been able, by means of numerous and extensive long-distance systems, to solve entirely novel, technical, and economic problems.

Relying on the fact that gas had thus so often been proved to be indispensable as a source of power and as a factor of "Kultur," the managers of gas-works in Germany felt confident, when the war broke out, that this cataclysm of the economic life of the Fatherland would not seriously prejudice the gas business. This expectation has been fully realized, for the business of the majority of German gas-works was only moderately affected by the war, and in many cases the effect was only temporary. During the first few months of the war, the increase in the sales of gas, which had until then averaged between 5 and 10 per cent., was replaced by a decrease of the same amount; but after the climax had been reached in September or October, this decrease became constantly less, and in the case of some works the sale of gas had once more increased by November, and still more in December last year. For instance, the average decrease in the sale of gas at our German works amounted, in August to ½ per cent., September 6 per cent., October 8·4 per cent., November 5·7 per cent., and December 5·2 per cent., as compared with the corresponding months of the previous year. The falling-off due to the war did not exceed 20 per cent. in the most unfavourable month at any of our works. It is easy to see from the monthly returns of individual works which classes of consumer contributed chiefly to this decrease. They are certain branches of industrial undertakings working chiefly for export—such as glass-works, businesses dealing in high-class clothing and luxuries, also railway stations, and particularly dancing saloons and other places of amusement. In the case of some works, nearly the whole of the decrease is due to the lower consumption of a few large consumers, and to the street lighting having been restricted. On the other hand, the great majority of the medium and small consumers have not restricted their gas consumption at all, or only very little. Even the prepayment meter installations, established for the most part in workmen's dwellings, show, in the majority of instances, no considerable falling off in the monthly quantity used, notwithstanding the fact that so many heads of families have been called to arms.

As the consumption of gas is well known to be an indicator of the state of the nation's economic life, the fact that the decrease in the consumption of gas since the end of the third month of the war has grown less—not only in the case of our own and other private gas-works, but also, as far as we know, in the case of most municipal works—enables one to draw the conclusion that industrial and domestic life in Germany is beginning to look-up again. It is true that the improvement is partly due to the fact that the war itself has brought up fresh consumers, some temporary and some permanent—particularly homes and hospitals for troops, where large quantities of gas are used for cooking and for heating water; also prisoners' concentration camps, which are powerfully lighted outside; and a very large number of households, small businesses and government offices, &c., where, owing to the dearness of petroleum and the higher price of methylated spirit, gas is now used. It is, of course, true that a portion of the fresh lighting is carried out by electricity.

It is a remarkable fact that, as is apparent from the Technical Journals of neutral countries, gas-works, not only in enemy but also in neutral territory, are, in some cases, suffering much more through the war than we are, and that the supply of gas has had to be much more restricted than in our case, owing to the difficulty of obtaining coal. This applies particularly to France and Russia; but in Switzerland and Italy also there have been many complaints as to the shortage of coal at gas-works. Moreover, while the great London gas companies increased the price of gas as early as September last by 2d. per 1000 cubic feet (equals ½ pfg. per cubic metre), which means that, even if the consumption is one-third less, a war tax of more than M.50,000,000 per annum is being paid by the inhabitants of the gigantic city, as far as we know no German gas-works has yet increased its price owing to the war.

Moreover, notwithstanding all the unfavourable influences and effects which have already made themselves very noticeable for German gas-works, owing to the war, and will probably continue to do so to an even greater extent, it is hardly likely that the managements will, to any considerable degree, take the step (so prejudicial to the public welfare) of rendering dearer the means of lighting and heating, indispensable for hundreds of thousands of people. On the contrary, the proprietors of gas-works will take upon themselves the sacrifices necessary in the interests of the Fatherland, resulting from the considerably higher price of coal, the shortage of labour, and the lower receipts obtained for bye-products. Of these prejudicial influences, the dearness of coal will probably be the most serious—particularly as, owing to the increased quantity of ash in the coal, the deterioration of the coke, which can no longer be exported, and the home market for which has been spoiled by the reduced price of coke-oven coke, and the exceptionally mild winter, makes matters even worse. The shortage of labour is noticeable, both at the works and out-of-doors, although at large gas-works provided with vertical retorts or chamber ovens, water-gas plant, and mechanical conveyors for coal or coke, the works can, if necessary, keep going with unskilled old hands, and the shortage is not so serious as in the case of middle-sized or small works.

There has, as yet, been no shortage of products required for the consumption of gas, and such shortage need not be feared even if the war lasts a long time, because the articles in question are nearly all made in Germany out of raw material produced in the country. It is true, however, that in the case of certain goods—particularly mantles, brass fittings, and metal and rubber tubing—the price is likely soon to increase, or has, indeed, already increased. Nevertheless, this increase can, to a large extent, be put on the shoulders of the consumer. Enemy countries and neutrals are experiencing almost as much inconvenience as Germany on this account, and also in consequence of the difficulty of importing the necessary materials. Even last September, Technical Journals in America expressed fears that, owing to the interruption of German exports, the supply of mantles and glassware to American gas-works would be seriously hindered. On the other hand, one of the London gas companies announced that it had in time assured itself of an adequate supply of thorium and cerium. The stocks of raw material and manufactured products needed for incandescent mantles which existed in Germany before the war broke out will suffice to cover home requirements for many years—particularly as the large export of these articles has been restricted.

Thus, it will be seen that the business of the German gas industry has hardly suffered at all from the war, and that its existence is in no way threatened. It goes without saying that during the war, and probably for some years after, its economic progress will show a considerable set-back, and very great efforts will be necessary to restore the profit derived from gas-works to its previous figure after the successful termination of the war. It would be a great help if the government and municipal authorities, who have during recent years often favoured the extension of electricity, would, after the war, bear in mind the fact—brought home to many people for the first time by the war—that the gas industry which makes full use of every constituent of coal, and prepares large quantities of products indispensable for the manufacture of material of the utmost importance from a military and agricultural point of view, has contributed, and can in future contribute, to a very large extent, to the maintenance of our warlike munitions and of our food supply.

Masonic.

The many friends in masonry, as also those who know him as a partner in the firm of Messrs. E. Foster and Co., will be gratified to learn that W. Bro. William A. Surridge—P.M. of the Eclectic Lodge, No. 1201, and who occupied the chair of the Evening Star Lodge, No. 1719, for the year 1910-11—has been appointed by the M. Wor. Grand Master (the Duke of Connaught) Assistant Grand Director of Ceremonies.

In the industrial centres of the West Riding, including the cities of Leeds and Bradford, which have hitherto been troubled very little in the matter of lighting restrictions, drastic orders were issued by the Military Authorities and came into effect last week. The street lighting has been reduced almost to the absolute minimum, and all house and shop lights are to be obscured. Not only must there be no outside lights to shops and no lighted advertisements, but the shop windows themselves must not be lighted inside to permit any light to shine out; and in shops where the interior lighting, apart from the windows, sends a glow into the street, this has to be prevented.

VALUE OF COKE-BREEZE AS A BOILER-FUEL.

[From a Correspondent.]

The writer of the article in the "Journal" for March 30, on the value of coke-breeze as a boiler-fuel, welcomes the opportunity of pursuing this subject which is afforded him by the editorial comments in the same issue.

The main trend of these comments was limited to the price at which the breeze is sold. All must agree with the remark that "if the price is a reasonable one, then there is no ground for objection, but rather the reverse, with an eye on the future." This is very true; and the writer would be the last to find fault with any such sales at a reasonable price, whether to competitors or to other fuel-users.

The whole question hinges upon the price at which the breeze is sold. The evidence on this point disclosed in the article is certainly somewhat unstable, as the editorial remarks. Nevertheless it may well be true; and the writer for one would be greatly surprised to learn that coke-breeze, screened free from coke, was being sold in the London district at 14s. or 15s. per ton delivered—its proper value for steam-raising purposes, at any rate in the writer's opinion, with slacks at 20s. per ton delivered.

If this be so, there is certainly no cause for criticism, but rather for congratulation. On the other hand, if coke-breeze is being sold at the price of 8s. per ton, as named in the article, it is suggested—and with this view the editorial agrees—that the fuel is being sold far under its proper value, having regard to the corresponding price of coal slacks with which it has to compete, and (what is a strong point just now) the paucity of the supply of such coal. It must not be forgotten that the supply of breeze to the electrical engineer at the present time is a great boon, and must appeal to him as greatly as would an additional supply of coal to the gas engineer—and one knows how much this would be appreciated. Therefore there is every reason to insist upon adequate prices for such fuel.

The writer has already given some idea of what he considers to be an adequate price for coke-breeze as boiler-fuel. He would place it roughly at three-quarters the market price of slacks, on whatever type of boiler it may have to be used. That is to say, whether it be consumed in electric generating stations (where mechanical stokers are invariably in use) or in hand-fired Lancashire boilers, its relative value to coal-slacks will be equally great. It can be used as a mixture with coal on existing mechanical stokers, or by fitting a somewhat different stoker it can be used alone and without admixture with coal. In either case, virtually the same duty is obtainable from a boiler as when fired solely upon slack. With hand-fired boilers it is, of course, essential the furnaces should be fitted with forced draught and closely-spaced fire-bars. When so fitted, a high duty is obtainable from a Lancashire boiler, and practically the same as when the latter is fired with slacks; for with breeze the boiler can be forced without causing smoke trouble, whereas with slack the reverse is the case. Thus, in selling coke-breeze, a comparison should be made with coal-slacks, and the price fixed in accordance with their relative values in British thermal units; for in comparing coke-breeze and coal-slacks higher labour costs are small enough to be negligible. On this basis coke-breeze should be saleable at much higher prices than has been customary; and at the present time there should not be the slightest trouble in obtaining full value for the fuel, owing to the difficulty of obtaining coal, its inflated price, and the small quantity of coke-breeze which can be placed upon the market. In connection with the last-named factor, it must be remembered that, for every 100 tons of coal-slack used in this country, there cannot be more than a fraction of 1 ton of coke-breeze available for sale.

The term "coke-breeze" is somewhat elastic. It may be coke dust with a liberal admixture of small coke, or it may be screened through small holes no larger than ⅜-inch diameter. It is obvious that the former is distinctly more valuable than the latter; but the above remarks are intended to refer to fine coke-breeze—through ⅜-inch diameter mesh. This fine breeze may contain twice as much moisture and 50 per cent. more ash than the coke from which it is screened; but, even so, the remaining composition is fixed carbon, amounting to quite 65 per cent. in fairly bad samples. It is thus not far removed from the slacks it has to compete with, and which frequently contain not more than 70 to 75 per cent. of combustible matter (fixed carbon + volatiles).

There is now the further point referred to in the editorial, as to the policy of selling a little-used and little-known fuel, such as coke-breeze, at a low price at the present time, so as to obtain extended trials and to advertise its value in the hope of creating a permanent demand for it in normal times. In discussing this matter, the editorial states that "there was a pre-war coke market, and there will be the after-war coke market." Very true; but we are talking of coke-breeze, not coke. Had it been "coke," the writer's remarks would have been very different. Practically speaking, very little coke-breeze is sold, or needs to be sold, by the gas-works of this country. Most of it is required as boiler-fuel in the gas-works itself; and a great many works find that their total production of coke-breeze is not nearly enough for their own use. Again, the fact that there has lately been a fair amount for disposal has been caused by the large quantity that has been stored up in the enormous coke stocks which have now been dispersed, and, as is always the case, have left behind them proportionately large heaps of coke-breeze. This is purely temporary. The writer, therefore, maintains that there is virtually no after-war coke-breeze market to be considered, and what market is required for this fuel is obtainable at the expense of exceedingly little trouble, by opening negotiations with two or three steam-users who would otherwise be using slacks.

As regards the relative effect of high coal prices upon gas-works and electric generating stations, the writer maintains that this factor has, not of necessity but actually, at least as great a result on the cost of generating electricity as it has on the cost of making coal gas. In making any such comparison, it is wrong, in the writer's opinion, to take the "total generating costs" in an electricity station and the "net manufacturing cost" in a gas-works, as is done in the editorial, as these charges include much beyond fuel costs, which latter is the actual question under discussion. The items to compare should be cost of fuel in the electricity station with cost of coal, less receipts from coke, in the gas-works. Assuming that an electricity company is selling current at an average price of 1½d. per unit, and a gas company gas at 2s. 6d. per 1000 cubic feet, and that each in normal times is paying for coal 14s. per ton delivered, and that fuel costs to the former are 0·35d. per unit and to the latter (coal, less coke) 7d. per 1000 cubic feet, we have a basis upon which to calculate the effect of a corresponding rise in the price of coal. Assuming again that coal in each case rises to 22s. per ton, what is the effect on the price at which electricity and gas can be sold? In the case of the former fuel costs will increase from 0·35d. to 0·55d. per unit, and in the case of the latter, if we take it that coke receipts will at all times pay half the cost of the coal, from 7d. to 11d. per 1000 cubic feet. Now what is the relative effect of 0·20d. per unit and 4d. per 1000 cubic feet on the sale price to the consumer? Electricity will rise from 1·5d. to 1·7d. per unit, and gas from 2s. 6d. to 2s. 10d. per 1000 cubic feet—in each case a rise of 13·3 per cent. These are merely assumed figures; but they are at least approximate, and show the general effect of fluctuations in the price of coal upon gas and electricity. Labour costs, which have increased considerably as a result of the war (owing to special bonuses and allowances to men with the forces), are a larger item to gas than to electricity companies; for wages per 1000 cubic feet of gas are higher proportionately than wages per unit of electricity.

LIQUID FUEL FROM COAL TAR.

The crude tar resulting from the distillation of coal being very acid, attempts have been made to neutralize it by treating it with lime or some other basic substance. The neutralization process which requires the use of large quantities of alkali, has also been adopted to separate the phenol from tar. No attempt has, however, been made to extract from the tar thus treated a product which, by its composition, may be used as a substitute for petroleum for lighting, heating, or motive power. The utilization of tar for the purposes named would tend to increase the sale to a considerable extent; and processes, on similar lines, for the preparation of a suitable product have been patented for France by MM. Markl and Lorand. The following particulars are taken from their specifications [Nos. 471,506 and 472,860 of 1914].

Crude tar, or the liquid residue, known as "Carbolineum," obtained after the distillation of its volatile products, is mixed with a very dilute aqueous solution, and allowed to rest with occasional stirring. As soon as the supernatant aqueous layer has a light garnet-red colour, which it acquires after a certain time, according to the degree of concentration of the alkaline solution, the tar is run off, and subjected to distillation. After the disappearance of the water and ammoniacal liquor, distillation gives an oil of a light colour, which constitutes the new product.

The following particulars are given by way of example: Tar or "Carbolineum," 100 parts by weight, is poured into a vessel containing 100 parts by weight of a 1 per cent. hot potash lye. The tar is mixed with the lye and allowed to rest for six hours, during which time it is occasionally stirred. When cool, the layer of tar is put into an ordinary type of distilling apparatus, which, however, must be large enough to prevent the froth caused by the water in the product being distilled from passing into the condenser. At a temperature of 100° C., water is distilled; and at 100° to 110° C., ammoniacal liquor. If the temperature is then raised to 130° to 150° C., a calm boiling is produced. At 200° to 280° C., a rather turbid oil flows off at first, and afterwards a transparent oil of a light colour, very suitable for heating and lighting. The characteristics of the new product are light yellow colour with a green fluorescence, very fluid, and with a slight odour of tar. At 15° C. its specific gravity is about ·9997.

Oil obtained in the manner described contains, per 100 parts by weight, 80·39 per cent. of carbon, 7·74 per cent. of hydrogen, and 11·87 per cent. of oxygen, nitrogen, &c. The calorific power of the oil is very great—viz., 8313 calories—as it contains 88·13 per cent. of carbon and hydrogen. The ignition-point is from 70° to 75° C.; the point of combustion, 110° to 115° C.; and the freezing-point below — 20° C. It is claimed that from 100 parts by weight of tar one can, by this process, obtain about 45 to 50 per cent. of the product in question; and that from 100 parts by weight of tar previously freed from volatile compounds 90 per cent. can be extracted. The residue from distillation can be sold for the manufacture of asphalt.

A BOLOMETRIC METHOD OF DETERMINING THE EFFICIENCIES OF RADIATING BODIES.*

By William A. Bone, F.R.S., H. L. Callendar, F.R.S., and H. James Yates.

[From the "Proceedings of the Royal Society," Vol. XCI.]

Introduction.

With the increasing use, within recent years, of gas-fires, electric-radiators, incandescent surface-combustion diaphragms, and the like, there has arisen a demand for a reliable general method for testing their radiant efficiencies. The problem is important also in its purely scientific aspects, inasmuch as its solution would enable the relations between the modes of combustion of various combustible gases and their radiant values when burnt at an incandescent surface to be investigated.

The present paper describes a bolometric method which we believe to be applicable to the measurement of the radiant energy emitted from hot terrestrial surfaces generally; but as the source of radiation in our experiments has been a gas-fire, it will be convenient if we describe it with reference to this particular mode of heating.

A typical modern gas-fire consists of a series of atmospheric burner-nozzles, varying usually between 7 and 15 in number, according to the size of the apartment to be heated, arranged equidistantly along a common horizontal supply pipe, provided with suitable means for properly adjusting the relative gas and primary air supplies so as to ensure a vertical series of non-luminous and, as nearly as possible, silent bunsen flames, of uniform height and character. Above each flame is fixed a hollow fire-clay columnal "radiant," perforated in a manner expressly contrived to promote uniform heating of the column throughout, and with each flame rising into the cavity of its particular radiant. Care is taken to prevent any impingement of the inner cone of the flame upon its radiant. The back of the fire is formed by a fire-clay slab fixed vertically behind the radiants, which are held in position by means of one slight horizontal iron rod. At a suitable distance above the top of the radiants is fixed a metallic hood or "canopy," by means of which the products of combustion are collected and discharged through the flue vent into the chimney without in any way contaminating the atmosphere of the apartment.

The object of a properly designed fire should be to secure the maxima of radiant and ventilating effects with a minimum of "flue heat;" and it is in connection with these aspects of the problem that the need of convenient and accurate means of measuring the radiant efficiency of a fire has been mostly felt.†

A Joint Committee appointed in 1907 by the University of Leeds and the Institution of Gas Engineers to investigate gas-fires adopted a method (now known as the Leeds method) for determining their radiant efficiencies. It consists essentially in firstly establishing, by thermopile readings, a relation between the intensity of the radiation at a central equatorial area on a hemisphere in front of the fire and the total radiation received over the whole hemisphere [a relation which will be hereafter referred to as the "distribution factor" of the fire], and then determining, by means of a radiometer of the water-calorimeter type, designed by Professor R. H. Smith, the actual number of calories radiated by the fire per hour on to the said equatorial area. The number of such calories multiplied by the "distribution factor" of the fire gives the total energy radiated by the fire per hour; and the relation of this to the total net heat developed by the combustion of the gas in the fire per hour gives the radiant efficiency of the fire.‡

This method, while perfectly sound in principle, is admittedly open to criticism on the following grounds:—

(1) The R. H. Smith radiometer is liable to various small indeterminable errors inherent in all such water-calorimeter radiometers, due principally to (*a*) imperfect absorption of the radiation by its blackened surface; (*b*) effects of "lag," which, however, if the experimental conditions remain constant, may be disregarded; and (*c*) the difficulty of carrying out a really satisfactory "blank" experiment to determine the allowance to be made in the actual test for heat gained by the instrument from the surrounding warmer atmosphere.§

(2) It is practically impossible, owing to the large area of the absorbing surface of such a radiometer, to standardize its readings from a known absolute radiation standard.

(3) The time taken to complete both the radiometer (actual and blank) tests and the 81 thermopile readings required to establish the "distribution factor" is considerable, and there is always a risk of some alteration during the test in the experimental conditions which would affect its result.

(4) There is also perhaps a little uncertainty about the absolute accuracy of the "distribution factor" as determined by the Rubens thermopile used in the Leeds method.

In any case, were the method entirely free from any or all such practical objections, it would still be important to compare its results with those obtained by some independent standard method.

The New Bolometric Method.

The problem of measuring the radiant efficiency of a modern gas-fire, such as has been described in the introductory part of our paper, is complicated by the fact that the fire front—*i.e.*, the seat of the radiation—cannot be regarded as a surface of simple geometric form. The seat of the radiation has, in fact, a measurable depth; and, owing to the line of the fire front being often slightly curved, its exterior surface is not always flat.

Again, the hemispherical distribution of the radiation may be disturbed either by absorption or by reflection from projecting surfaces on the casing of the fire. It is necessary to determine not only the whole radiation emitted by a particular fire, but also its distribution factor, because a proper distribution of the radiant energy is almost as important as its total amount.

The Bolometer and its Advantages.

We propose to substitute for the radiometer-*cum*-thermopile device in the Leeds method a simple bolometer in which the radiation falling from the fire upon a blackened coil of platinum wire can be deduced from the observed increase in its electrical resistance, the area of the receiving coil being sufficiently small to allow of the instrument being standardized directly from a source of radiation of known intensity.

The principal object in employing a bolometer in place of a thermopile is to secure a greater range of accuracy and sensitiveness, and to facilitate the obtaining of automatic records when required. The sensitiveness of a bolometer is readily varied over a wide range by varying the electric current employed for measuring the resistance. The sensitiveness may also be determined very easily, under any conditions, by observing the deflection produced by inserting a known resistance in the circuit. In using the Rubens thermopile (as in the Leeds method), it is found necessary to attach a reflecting cone to the instrument in order to obtain a deflection of 25 scale-divisions with a Paul unipivot galvanometer at a distance of 3 feet from a 10-inch gas-fire. The use of a reflecting cone narrows the angular aperture, and introduces some uncertainty with regard to the extent of the source from which the radiation is actually received. The bolometer, when supplied with the current for which it is designed, and employed in conjunction with the same unipivot galvanometer but without any reflecting cone, is found to have a sensitiveness about thirty times as great as the Rubens thermopile with the cone, and could be used at much greater distances from the fire. By adjusting the sensitiveness to a suitable figure in scale-divisions per ohm, it is always possible to obtain deflections in the neighbourhood of 90 or 100 scale-divisions, which greatly facilitates the accurate determination of the radiation.

Construction of the Bolometer.

The familiar type of bolometer invented by Professor Langley has a sensitive receiving surface in the form of a grid cut from thin metal foil, and is blackened with smoke black or platinum black. This method of construction was adopted with the object of securing the greatest quickness of action; but it involves extreme fragility, and is wanting in constancy. The coating of black invariably deteriorates, and cannot be renewed without altering the constant of the instrument. Constancy is much more important for the present purpose than quickness of action; and fragility would be a serious defect.

A different method of construction was accordingly adopted in our experiments. The delicate grid of the Langley bolometer has been replaced by a coil of platinum wire wound on a thin piece of mica, and coated to an even surface with hard black enamel, which is extremely permanent, and can be cleaned without risk of injury. Two exactly similar coils, each 4 cm. square and of 20 ohms resistance, are mounted back to back on either side of a circular gun-metal box, provided with water circulation and with suitable covers for the coils, so that either coil can be exposed to radiation or screened. When both coils are screened, they are kept at the same temperature as the box; their resistances remain equal; and there is no deflection of the galvanometer, however much the temperature of the box may change. But if one of the coils is exposed to radiation, its temperature and resistance are increased by an amount depending on the intensity of the radiation; and the galvanometer shows a deflection proportional to the

* An abstract of this paper, as issued by the Society, appeared in the "Journal" for March 9, p. 585, at the time of its presentation to the Society the previous Thursday.

† See also H. James Yates on "Recent Progress in Gas-Fire Science," "British Association Reports," Birmingham, 1913, pp. 435-9. ["Journal," Vol. CXXIII., p. 841.]

‡ A full description of the Leeds method is given in the Committee's first and second reports, "Transactions of the Institution of Gas Engineers," 1909, pp. 59-81. ["Journal," Vol. CVI., p. 821.]

§ There is certainly a small systematic error in the "blank" test, due to the impossibility of screening the radiometer perfectly from the fire during the blank, the effect of which is to make the ascertained "blank correction" too high. By means of the bolometer we have estimated that, in the case of a 10-inch gas-fire, and using a single reflecting screen in front of the radiometer during the Leeds blank test, the error may amount to 0·44 kilogramme-calorie per hour on a total centre reading (in the actual test) of 55 to 60 kilogramme-calories.

increase of resistance, which serves as a measure of the intensity of the incident radiation.

Calibration of the Bolometer.

An instrument of this type can be directly calibrated to give the intensity of the radiation in absolute measure, by observing the magnitude of the electric current required to produce the same rise of temperature, or increase of resistance, as the radiation to be measured. This method has often been adopted, but is not quite satisfactory, on account of the uncertainty of the absorption factor of the surface for radiation, which is one of the commonest sources of error in all measurements of radiation. The constant of the bolometer, giving the intensity of the radiation in terms of increase of resistance, was accordingly determined by comparison with a radio-balance—an instrument specially designed to give total absorption of the radiation.*

In the radio-balance, the radiation to be measured is admitted through a small circular aperture and received in a blackened copper cup, in which the absorption is practically complete. The heat received from the radiation is balanced by absorption of heat due to the Peltier effect in a thermo-junction through which a measured electric current is passed. This method is very accurate, but is not well suited for ordinary use outside a physical laboratory, because it requires a sensitive galvanometer for indicating the balance, and a delicate ammeter or potentiometer for measuring the electric current. Nevertheless, a bolometer such as the one herein described can, without risk of fracture of its working parts, be sent to a physical laboratory for comparison with a radio-balance.

The following table contains all the results for the constant of this particular bolometer obtained by comparison with two different radio-balances, denoted by "D" and "E" respectively. Two

Observations of Bolometer Constant K.

Date, 1914.	Radio-Balance.	Temperature of Bolometer.	Air.	Source of Radiation.	Constant of Bolometer.
		Degrees.	Degrees.		
July 25 . .	E	21·5	22·0	Gas-fire	27·71
,, 26 . .	E	21·0	21·5	Focus-lamp	27·85
Nov. 28 . .	D	15·7	18·0	Gas-fire	28·09
,, 29 .	D	17·2	18·7	Focus-lamp	28·02
Dec. 1 . .	D	17·7	18·0	Gas-fire	27·82
,, 3 . .	E	18·9	18·2	Focus-lamp	27·96
,, 3 . .	D	18·7	18·3	,,	27·86
,, 5 . .	E	20·7	19·2	Gas-fire	27·82
,, 6 . .	E	18 3	21·2	,,	27·78
Means. . . .		18·9	19·4	—	K = 27·88

different sources of radiation were employed: (1) A 10-inch gas-fire at a distance of 1 metre; (2) a focus-lamp of 100-candle power, having a small radiant 1-inch square, at a distance of 30 cm. It was unfortunately impossible to vary the temperature of the laboratory materially; but the temperature of the bolometer was altered 5° or 10° on each occasion, by changing the water circulation, in order to determine the correction for the difference of temperature between the bolometer and the air. The results given for the constant are corrected for the observed difference.

The value of the constant is given as the intensity of the radiation in kilocalories per square foot per hour required to produce an increase of resistance of 1 ohm in the exposed coil of the bolometer. The chief source of error in the comparisons was the uncertainty of temperature of the surrounding air and the walls of the room, which cannot be well avoided in measurements of this kind with a source of large area like a gas-fire, since the receiving instrument is necessarily exposed to the air and to radiation from surrounding objects, which may be at different temperatures. The correction for difference of temperature between the air and the bolometer was found to be 0·028 ohm per 1° C., and amounted in some cases to as much as 4 per cent., when the difference of temperature was considerable. But the divergence of the corrected results from the mean in no case reaches 1 per cent., and is generally less than 0·5 per cent.

The Distribution Factor.

The "distribution factor" of a gas-fire, or other approximately flat source of radiation, may be defined as the factor by which the normal intensity at a given distance D must be multiplied in order to obtain the total radiation emitted over a hemisphere. If the source is a plain circular disc of uniform intensity and of radius R, the value of the factor given by the theory of radiation for a self-luminous surface would be simply $\pi (D^2 + R^2)$. Thus, for example, in the case of a plane source 1 foot in diameter, tested at a distance of $9/\pi$ feet, or 34·38 inches, the value of the distribution factor should be 26·58, which is about the value generally obtained for a 10 inch gas-fire, tested at this distance, by taking a large number of readings equally distributed over the surface of a hemisphere. In the case of a gas-fire the surface is, however, seldom flat; and there are considerable extensions, such as the canopy, which contribute an appreciable fraction of the radiation. The chief uncertainty arises in estimating the distance D. An error of 1 inch in D, in the above example, would make an error of nearly 6 per cent. in the mathematical formula; and it may be doubted whether this error can be eliminated in practice by taking observations over a hemisphere of fixed radius.

The obvious method of reducing this uncertainty—especially with a large gas-fire—would be to increase the distance. But this introduces some practical difficulties if a great number of readings are to be taken over a hemisphere of large radius. It is doubtful whether an accurate result can be obtained by mere multiplication of readings. Since the deviation of the distribution factor from the theoretical value for a flat surface is evidently small, it would probably suffice to take a few readings at suitably selected angles. It appears from theory, and also from comparison of observations, that the sum of four readings taken at 60° along the equator and meridian, together with the central reading, multiplied by $\pi D^2/3$ (8·6, when $D = 9/\pi$ feet), gives as good an approximation to the total radiation as can be obtained by taking 81 readings. The distribution factor is represented by the sum of the five readings divided by the central reading and multiplied by $\pi D^2/3$.

Effect of Variation of Temperature of Receiver.

The importance of keeping the temperature of the receiver (whether bolometer or thermopile) constant is best appreciated by taking a case in which this precaution is omitted. If a Rubens thermopile with a Paul indicator—such as is used in the Leeds method—is exposed to a steady source, giving an intensity of 46 kilocalories per square foot per hour, the deflection rises to about 25 mm. in 15 to 20 seconds, and creeps up to 27·5 (a further 10 per cent.) in three or four minutes. The deflection then diminishes to about 25 mm. if the exposure is prolonged, on account of rise of temperature of the case, which may amount to 5° or 10° C.

If, now, the hot instrument is screened from the source, or turned towards the wall of the room, which is at a lower temperature, it falls quickly to zero, and gradually takes up a negative deflection of 3 or 4 mm. In other words, the rise of temperature of the instrument may produce an effective change of zero equivalent to 10 or 15 per cent. of the deflection. Variations of this magnitude make it impossible to employ the pile with a constant reduction factor for determining the absolute value of the radiation. In using the pile merely for the distribution factor, the errors are not so obvious; but, being systematic, they produce a marked effect on the results, as is shown by the following typical comparison of readings taken with a thermopile and a bolometer, along the equator in front of a gas-fire:—

Position	60° West.	0°.	60° East.
Thermopile	16·0	23·3	13·0
Bolometer	58·2	91·2	58 0
Thermopile	15·2	22·9	13·0

The thermopile readings make the distribution appear about 20 per cent. greater on the west than on the east. There is no reason why this should be the case; and the bolometer readings show practically no difference between east and west. The explanation is that in the case of the thermopile the west readings were taken first, while the deflection was still increasing, whereas the east readings were taken after the instrument had become hot, with the consequent depression of zero. The opposite errors on the two sides tend to neutralize each other to some extent; but the general effect is to reduce all the smaller readings unduly as compared with the central reading, so that the distribution factor obtained with the thermopile may be as much as about 3 to 5 per cent. too small. This point may be illustrated by reference to the following table of the "Distribution Factor" of the same 10-inch gas-fire as determined on several different occasions by means of (1) the bolometer, and (2) a Rubens thermopile.

Distribution Factor of a 10-inch Gas-Fire as Determined by—

Bolometer.	Thermopile.
28·23	27·42
28·56	27·55
28·65	27·12
28·30	27·55
28·70	27·57
28·16	27·68
27·97	27·52
28·52	27·13
27·81	
28·52	Mean = 27·44
28·47	
	Ratio $= \frac{28·36}{27·44} = 1·034$.
Mean = 28·36	

Method of Testing a Gas-Fire.

It is usually the most convenient method, in testing a gas-fire, to mount the bolometer or thermopile on a revolving sector of fixed radius, the centre of which is adjusted to coincide approximately with the centre of the fire. If the radius of the hemisphere over which the bolometer moves is $9/\pi$ feet, or 34·4 inches (as employed in the Leeds method), an error of 1 inch in the adjustment of the sector along the normal will produce an error of 6 per cent. in the central reading.

It is difficult to specify accurately how this adjustment should be made, especially if a radiometer of large receiving surface—such as 1 square foot—is employed for the central reading. The Leeds method of testing throws too much weight on the central reading, which is the most uncertain so far as the adjustment is concerned. The reasons for taking four readings at an angle of

* "Proceedings, Physical Society of London," Vol. XXIII., pp. 1-34 (1910).

60° with the normal are: (1) That these readings take very fair account of the variation of distribution in different directions, (2) that the sum of the four readings will be very nearly independent of small errors of adjustment of the sector, and will reduce to about one-third the probable error of adjustment on the central reading.

Automatic Records.

It is possible with the bolometer to obtain automatic records in ink on a large scale, which are useful in recording the progress of a test, or showing the effect of variation of conditions. The scale is readily varied from 10 to 40 cm. per ohm. The reading obtained with a 10-inch gas-fire at a distance of 3 feet is generally between 1·5 and 2 ohms with the bolometer already described. This reading would correspond to a vertical height of 15 to 80 cm. on the record according to the scale employed. The smaller scale is quite sufficient for an ordinary test; but the larger scale is useful in investigating small corrections, due to variation of temperature of the room or similar causes. Readings can be taken more quickly with an indicator such as the unipivot galvanometer already mentioned; but the recorder has the advantage that its scale is more accurate and uniform, and that it is easier to see when the conditions of observation are satisfactorily steady.

Radiant Efficiency of a Gas-Fire.

In conclusion, we may tabulate the results of a series of determinations of the radiant efficiency of a 10 inch gas-fire working on London coal gas of average net calorific value 32·88 K.C.U. per cubic foot at N.T.P., with an average consumption of 24·25 cubic feet per hour at N.T.P., supplied to the fire at a constant pressure of 1·9 inches (water-gauge) above the barometric pressure.

Date. 1914.	Barometer.	Dry Gas Consumption per Hour at N.T.P.	Net Calorific Value Dry Gas K.C.U. per Cub. Ft. at N.T.P.	Radiant Efficiency.
	Mm.	Cub. Ft.		per Cent.
Dec. 9 . .	750·3	24·00	132·0	44·8
,, 10 . .	752·5	24·49	131 0	45·0
,, 11 . .	746·1	24·25	130 6	43 2
,, 14 . .	732·7	23·78	130·2	46 0
,, 16 . .	748·4	24·19	131·8	46·6
,, 17 . .	761·1	24·77	132·3	44·6
	764·7	24·49	132·3	44 6
	763·2	24·51	131·7	45·5
	763·2	24·26	131·7	45·5
,, 18 . .	751·4	23·82	130·6	44·0
			Mean . .	45·0

The testing room was a laboratory 38 ft. by 32 ft. 6 in. by 15 ft. high, the temperature of which varied only between 14° and 17° C. during the various tests. The fire was mounted on a special stand, with its flue outlet under a large hood communicating with a chambered wall and chimney which gave a sufficient draught to prevent any of the products of combustion getting into the room.

The five bolometer readings in each test were taken at radial distances of 34·4 inches from the centre of the fire—one central reading and four other readings in positions 60° N., S., E., and W. respectively, of the central position. A mean "distribution factor" of 28·36, as determined for the fire, was used in the calculations.

Finally, the authors desire to thank Messrs. A. Forshaw, M.Sc., and S. Farrar, B.Sc., for their assistance in connection with the experimental part of the investigation.

CALORIFIC POWER LOSSES UNDER PRESSURE.

In a short paper read by Mr. Willard O. Brewer, of Meriden (Conn.), before the New England Association of Gas Engineers, he gave the following particulars of tests of gas to ascertain the loss of calorific power sustained by transmission through a pipe-line under medium pressure to a distant point for distribution.

The Meriden Gas Company have for the past two years maintained a calorimeter in the laboratory; and the heating values of carburetted water gas and mixed gas have been determined daily at least, as well as the candle power. In order to ascertain the loss due to compression and transmission, the gas subjected to the most severe conditions was taken. A medium-pressure 6-inch line supplies the village of Southington, eight miles distant from Meriden; and branching from it is a 6-inch line which serves Cheshire. Last November, at the time of the tests, the consumption of gas in the district was between 55,000 and 65,000 cubic feet daily. The gas was subjected to a pressure which varied from 7 to 100 inches of water, depending upon the consumption at various times during the 24 hours. The line to Southington crosses five short bridges; but it is well protected from low temperatures. A calorimetric testing-station was located at the gas office in Southington; but in Meriden the testing was done in the laboratory at the works, about 10 feet from the holder from which the gas was drawn to send over this line.

The outline of tests included a determination at Meriden of lighting and heating power, the dew-point, benzol, and illuminants, in the order given, and at Southington a calorific and dew-point determination, and the collection of samples of gas for analysis at Meriden. The chief difficulty was the obtaining of the same sample of gas at both places. Estimation of the contents of mains gave 20,000 cubic feet, apart from services. The fact that the main was in the form of a T, and that there was no way of telling how much each branch consumed, made exact calculation impossible. Finally the figure of 17,000 to 20,000 cubic feet was taken to be the amount to be passed through the meter from the time of the test at Meriden to that of the test at Southington. Thus tests in Southington in the middle of the afternoon were made on approximately the same gas as that tested during the last part of the morning at Meriden. Owing to uncertainty as to whether or not the samples were of the same gas, the daily results are not strictly comparable; and the average of several tests, covering as many days, seems to show best the actual conditions. Not only this, but such gas was subjected to the greatest pressure of the day, due to largest consumption then and the necessary speeding-up of the exhauster. Gas analyses were not obtained every day, and are placed separately, because it was deemed that they were not necessarily on the same gas as the other tests, but indicated nevertheless a good average of relative changes in benzol and illuminants, due to compression and transmission.

Meriden.				Southington.		
Dew Point, Deg. Fahr.	Candle Power.	B.Th.U.	Inches Water Pressure (at Exhaust Outlet).	Dew Point, Deg. Fahr.	B.Th.U.	Inches Water. Pressure.
53	17·70	588·3	100	50	589·3	45
54	17·40	602·0	100	49	594·3	45
54	17 94	601·8	84	50	606·9	45
54	17·88	621·5	84	48	608·3	50
56	17·91	617·5	84	53	608·7	50
57	18·52	618·2	84	50	614·4	50
52	17·87	615·5	84	52	613·8	50
55	18·28	610·2	84	51	604·7	50
52	18·24	616·5	84	47	619·1	50
55	17·20	614·4	62	52	613·3	35
55	16·84	601·5	62	50	598 0	40
48	17·52	611·2	60	46	620·1	40
50	16·56	597·8	62	44	597·6	45
52	17·30	603·1	60	46	596·4	35
50	17·14	600·6	60	47	596·8	45
48	17·34	612·9	60	41	600·6	45
52·8	17·60	608·3	..	48·5	605·1	..

Gas Samples.

Meriden.		Southington.	
Per Cent. Benzol.	Per Cent. Illuminants.	Per Cent. Benzol.	Per Cent. Illuminants.
1·10	5·65	1·00	6·05
1·20	7·75	0·65	7·70
1·55	7·80	1 00	7·70
1·15	7·65	0 75	6·75
1·30	8·05	1·00	8·20
1·30	7·65	1·00	7·25
1·25	7·50	1·10	7·30
1·25	7·75	1·20	8·40
1·25	6·10	1·20	6·50
1·30	7·40	1·25	6·45
1·55	7·75	1·05	7·35
1·29	7·37	1·02	7·24

It is noted that the loss in the calorific power amounts to 3·2 B.Th.U., or 0·52 per cent., while the benzol loss is 0·27 per cent., and that of the illuminants 0·13 per cent. The author regrets that candle power determinations could not be made at Southington, as undoubtedly the light loss would have been greater than the heat loss.

The calorimeters used were a Sargent and the Company's own—a late type of Hinman-Junkers. Preliminary to the tests the meters, which had been standardized by a 1-12th cubic foot bottle, were checked against each other, and found to indicate the same. Average tests on the same gas by each instrument showed that the Hinman-Junkers gave 0·3 per cent. higher results.

Candle powers were read on an 80-inch closed bar photometer with a 2-candle standard. This gas was tested with a Sugg "D" low-cone burner. Comparisons of this burner with a 7-feet Bray "special," and a Bray 8-feet economizer, slipped over a 3-feet regulator, on the same grade of gas as that used in the tests, showed the 7-feet burner as 1·000, the 8-feet one as 1·044, and the Sugg as 1·122—or for a 17·60-candle power gas by the Sugg, as in the average of the tests, the 8-feet would give 16·38-candle power, and the 7-feet 15·69-candle power.

Yorkshire Junior Gas Association.—Arrangements have been made for members of the Association to visit, next Saturday afternoon, the Hebden Bridge Gas-Works, where, by permission of the Engineer (Mr. E. J. Wellens), they will inspect a complete installation of "Dempster-Toogood" continuous vertical retorts, of a capacity of 250,000 cubic feet per day, and a further similar installation in course of construction.

INFORMAL MEETING OF SCOTTISH GAS MANAGERS.

ANNUAL GATHERING IN GLASGOW.

The Thirty-Second Annual Meeting of Scottish Gas Managers was held at the Grand Hotel, Charing Cross, Glasgow, on Wednesday last; the attendance numbering nearly a hundred. At the outset,

Mr. J. W. NAPIER (Alloa), the Convener of the meeting, said he thought it was important that, even in the stress and trouble of warfare, they should meet, in order to consider the position of matters as it affected the gas industry. The meeting that day was quite unique in the annals of Gas Managers' Associations, because as an industry they were taking a not unimportant part in the affairs that troubled the countries of the world. Those present would doubtless recollect that the gas industry had—not only because of the use of gas in manufactures, but also for the value of the bye-products—played a very important part indeed; and it was only proper that as an Association, at this particular time, they should meet and confer together, not only in regard to the matter he had just alluded to, but with regard to the troubled condition of the industry so far as coal was concerned. They all deplored the circumstances that had brought about so large an increase in the price of coal, together with the diminution in the value of bye-products; but it would be their duty, as representatives of the important gas industry, to take up such a position as would prevent the increase in the price of coal being more than normal, or at least what was deserved—having regard to the extraordinary circumstances. He then called upon the President, Mr. Dugald Currie, of Airdrie, to deliver his address.

THE LATE MR. BLAIR.

Mr. CURRIE, before proceeding with his address, said he desired to make reference to the great loss the gas profession had sustained through the recent tragic and lamentable death of their late esteemed colleague, Mr. William Blair, of Helensburgh. Most of those present would be aware that Mr. Blair was a regular attendant at all their meetings, and was ever ready and willing to give his opinion and advice on all matters which they had before them for discussion. His striking personality, his genial manner, together with the outstanding enthusiasm which he always manifested in furthering the interests of the gas industry, commanded respect and admiration from all his colleagues in the gas profession. One and all of them, he (Mr. Currie) was sure, extended their heartfelt sympathy towards Mrs. Blair and the members of the family in their sore and sad bereavement.

THE PRESIDENTIAL ADDRESS.

Gentlemen,—My first duty to-day is to thank you for the high honour you have conferred on me by electing me to preside at this meeting. I can assure you I appreciate the honour, and I hope I shall be able to discharge the duties of the chair to your satisfaction.

THE WAR AND COAL SUPPLIES.

Perhaps the most important matter engaging the minds of gas managers to-day—outside of the unfortunate National crisis through which the country is now passing—is the important question of coal supplies; and as this question is of such vital importance to the industry which we represent, it is my intention to make reference to the subject at the outset of my address.

Several months ago the gas industry, in common with the other great industries in the country, began to feel great anxiety in regard to the supply of coal to meet requirements; and as time advanced this anxiety became more intensified as the deliveries to gas-works began to shrink to an alarming degree. The shortage of supplies to many undertakings was such that reserve stocks had frequently to be encroached upon so largely that in many towns the continuance of the supply of gas was endangered. The cause of the shortage of supplies has been reputed to be due to lessened output of coal at the pits through large numbers of miners having joined His Majesty's Forces.

When the question of coal deliveries began to assume a serious aspect for the gas industry, the representatives of the leading gas undertakings throughout the country, with commendable promptitude, made strong representations to the Government, by means of deputations and resolutions requesting the Government (1) to endeavour to relieve the situation by temporarily suspending a section of the Miners' Eight Hours Act, whereby miners and underground workers might be allowed to work more than the Statute number of hours per day, for the purpose of increasing the output of coal at the various sources of supply, and (2) for the better organization of our transport systems to facilitate more prompt and regular deliveries of the coal.

You are all fully aware of the result of these influential representations; and it is to be regretted that the Government did not see their way to take prompt and immediate action to meet the wishes not only of the large industries concerned, but of almost the whole people of the country. While suffering from the scarcity of supplies, it seems incredible the Government should have allowed coal to be exported almost daily from these shores to neutral countries, notwithstanding the fact that our industries at home were being crippled for want of supplies.

It is also to be regretted that the Government took no action to prevent the inflation of prices to the extent now ruling; and, as large purchasers of coal, we have reason to deprecate the unpatriotic action of the coalmasters in taking advantage of the country's unfortunate position by raising prices to such an unreasonable and exorbitant standard.

While admitting that the cost of producing coal has increased in consequence of the war, I have no hesitation in saying that coalmasters will find the utmost difficulty in substantiating the fact that the additional cost of production has necessitated an increase in the price of coal to the extent of 75 to 100 per cent., which is approximately the rate of increase in the price since the war began.

As an industry we have reason to feel thankful that almost without exception we have been able to pull through the strenuous period referred to without having to disappoint the large communities who depend upon us for a supply of gas for heating, lighting, and power purposes.

THE OUTLOOK.

The outlook for the immediate future is anything but favourable; and I venture to predict that the utmost difficulty will be experienced in getting increased supplies in such quantities as to replace the large reserves taken from stock during the past few months, and which will probably be necessary to meet our next winter's requirements in the event of the war lasting that length of time.

At this time of year, our minds naturally turn towards the prospect of entering into contracts for our next year's supplies; and although we are now well advanced into the spring, there is no prospect of prices relaxing to any appreciable extent, which clearly indicates that we must be prepared to face a large increase in coal bills next year. It is to be hoped, however, that during the next two or three months prices will recede somewhat to permit of us entering into our usual contracts, and that, although we may have to pay a higher price, the increase will not compel us to raise the price of gas beyond our present anticipations.

A STANDARD SPECIFICATION FOR COAL.

While dealing with the coal question, it occurred to me that the present time is most opportune to consider the advisability or otherwise, of introducing a standard coal specification and model form of conditions of contract, which could be used by all undertakings when purchasing their supplies of coal. It is quite true that many undertakings purchase coal to their own specification and conditions of contract; but I am strongly of opinion that, should we adopt some standard form of specification and conditions of contract, our position as large coal purchasers would be considerably strengthened. In unity lies strength; and in times like these, when we are expected to pay exorbitant prices for coal, it is our duty to see that we obtain value for our money, and also that we get regular and sufficient deliveries, no matter what the ruling prices may be from time to time.

Many gas undertakings which are under contract for their coal supplies are at the present time completely at the mercy of coal contractors, both as regards the quantity and quality of coal supplied. Such a state of matters should not be permitted to exist; and I venture to say that with a standard coal specification and some binding form of conditions of contract, drafted upon sound business lines and supported by the whole of the undertakings in Scotland, we should be able to remove grievances that have disturbed the minds of gas managers for years past. To illustrate the weakness in our present system, it is only necessary to remind you of the commonly phrased advertisements which appear in the Technical Press and in the newspapers from time to time, inviting tenders for the supply of (say) screened coal; and in cases where such tenders are received and accepted without having a detailed specification of the manner in which the coal is to be screened and handled, it stands to reason that the coalmaster is practically given power to screen and handle the coal very much at his own discretion. It frequently happens that gas managers, previous to entering into contracts for their supplies, obtain trial waggons of the coal in which they are interested for testing purposes; and as the coal generally supplied under these conditions is well screened and perfectly clean, the results obtained sometimes turn out so satisfactory that perhaps a large order is placed. The manager having tested the trial waggon naturally expects to be supplied during the currency of the contract with coal of equal quality; but in many cases his expectations are rudely shattered, as not infrequently supplies are given which can come neither under the category of being screened nor well handled.

In connection with supplies of washed coal such as nuts, we again place ourselves very much in the hands of the coalmasters, as I am not aware of any recognized standard being adopted even by the coalmasters themselves as to the mesh or width of opening in the screens to pass the various sizes of nuts which they sell. On the other hand, we invariably receive deliveries of washed coals in a very wet condition; and although I understand that some collieries make due allowance for the excess of moisture in

the coal, there are others that make little or no allowance, with the result that in many cases we have frequently to pay for the weight of water or moisture which is contained and delivered with the coal. Again, in connection with deliveries we are not much better off, as we have generally to accept the coalmaster's excuses for non or insufficient deliveries, without having facilities afforded us to test the accuracy or inaccuracy of their statements. When pressing for deliveries, it is quite a common excuse for coalmasters to say that the output has been reduced or stopped through some accident or breakdown at the pit, and consequently, deliveries are reduced or suspended. But the manager so affected under our present system is generally not in a position to verify or contradict such excuses, with the result that these excuses may be put forward at times when the coalmaster is anxious to take advantage of a firm market, irrespective of the inconvenience he may cause the gas undertakings he has agreed to supply.

Having enumerated a few unsatisfactory points in connection with our present system of coal contracting, I trust the question of inaugurating a standard coal specification and model form of conditions of contract will receive the consideration and support that the subject deserves, and, if I may suggest it, that the matter be seriously considered by the Council of the North British Association of Gas Managers.

POSITION OF COKE.—VALUE OF COMMERCIAL SECTIONS.

The next subject I intend to deal with is the coke question, which has taken a foremost place in our minds during the past year. In the early autumn almost every gas-works in the country carried large stocks of coke, which became larger as the year advanced, and, as a result of the high stocks prevailing, the prices obtained for the fuel depreciated to a very low figure. In connection with the low prices being obtained at that time, I am afraid that we had ourselves to blame to a very large extent, as some members of our profession, whether through selfish motives or panic, made desperate efforts to reduce their stocks at the expense not only of their own undertakings, but to the financial loss of other undertakings which were prepared to stand together in order to secure a fair value for their commodity.

It is not my intention to go into the details of the undercutting of prices which took place; but I hope, as a result of our past experience, that efforts will be made to co-operate more with one another to prevent a similar state of affairs taking place in the future. It is surely common knowledge that Commercial Sections exist in our midst for the purpose of exchanging views as to the prices ruling for coke from time to time, as well as for other commodities; and it seems strange to me that more advantage is not taken of these organizations by gas managers to assist them in furthering the interests of their undertakings. Out of over 260 gas undertakings in Scotland, I regret to state that only 75 are represented as members of Commercial Sections—35 members being attached to the Eastern District, and 40 to the Western District. With the lack of interest in the Commercial Sections which these figures portray, it is not to be wondered that our progress in the direction of co-operation is so slow; and I would strongly appeal to those members of the profession who have up to now stood aloof from joining these Commercial Sections to become identified with them as soon as possible, if we are to endeavour to have an honourable understanding with one another regarding our trading business. It is almost hopeless to endeavour to regulate the prices of coke or anything else if over two-thirds of our number prefer to conduct their business on the old lines by competing against one another, without having regard to the financial results.

Since the beginning of the present year, as a result of the high prices charged for coal, it is gratifying to find that the demand for coke for almost all purposes has increased to such abnormal proportions, and that as a result of the great demand we have been able to obtain much more satisfactory prices. Throughout the country, it is also pleasing to learn that the huge stocks of coke are now rapidly diminishing, and in some cases stocks are actually sold out, which points to a better market for char in the coming year. One gratifying feature in connection with the present demand for this product is the manner in which householders have taken to the fuel for domestic purposes. In future, our constant aim should be to take advantage of the free and practical advertisement coke has obtained in the past few months by endeavouring to do our utmost to retain the custom that we have recently acquired. This can be accomplished to some extent by paying prompt attention to orders placed at the present time, and also by endeavouring as far as possible to supply the fuel in a dry condition and with as low an ash content as possible.

THE FUTURE OF TAR.

Regarding the other residual products, it is regrettable that the tar market shows no signs of improvement due to the fact that large stocks of pitch are being carried by manufacturers throughout the country; and while some of us have not been affected by the recent low prices paid for tar, owing to our output being sold under contract at a fixed price over the whole year, there are other undertakings which have not been so fortunate, as they have been selling on a sliding-scale basis, which only permits of them receiving the current value of the tar from time to time. No doubt these undertakings will feel some shrinkage in their tar returns this year.

The future for tar is not very encouraging; and we cannot hope for much improvement in the market until the demand for pitch greatly increases. Another factor which will tend to keep down the price of tar is the fact that the expenditure by local authorities on road construction will be considerably reduced or curtailed during next year in order to meet the wishes of the Treasury in regard to the keeping down of capital expenditure. I also understand the Road Board have meantime suspended the grants which they usually made to local authorities towards the cost of the construction of roads. Taking all things into consideration, there is every indication of our receiving a decreased value for tar next year.

SULPHATE OF AMMONIA.

Sulphate of ammonia, on the other hand, has improved considerably in price during the past six months; but whether the high prices existing of late will be maintained for any length of time is a matter beyond our anticipations. It is our duty, however—whether as sulphate manufacturers or sellers of ammoniacal liquor—to do everything in our power to retain the markets we hold at present for this commodity, and, if possible, by united action and co-operation, to extend and further them, as there is no doubt whatever that, at the end of hostilities, our formidable competitor, Germany, will exert every means in her power to endeavour to recapture the trade that she has recently lost in the supply of this material.

It is almost unnecessary for me to bring before you the good work being accomplished by the propaganda and selling branches of the Sulphate of Ammonia Committee; and those of you who have not given support to the Association in the past should seriously consider the advisability of doing so without delay. The confidential weekly returns issued to members of the Association are invaluable to gas managers, as the returns not only give the current prices being obtained at different ports from week to week, but frequently very accurate information is given regarding the tendency and prospects of the market.

When it is considered that the demand for sulphate of ammonia in this country is limited, and that we have to depend to a great extent on our export trade, the necessity of our supporting an organization which looks after our interests in the countries where the product is in demand will be readily understood.

GAS APPLIANCES AND THE HOUSE LETTING ACT.

The next matter I intend to touch upon is the effect the recent House Letting (Scotland) Act has had on gas undertakings in Scotland. Since the Act came into operation, we in Airdrie have experienced much trouble and difficulty in connection with the frequent changing of tenants in certain classes of houses known as the monthly lets. The chief difficulty we have experienced is in connection with our cooker and slot-meter business. It frequently happens that when a tenant enters into possession of one of these houses, he (or she) makes application to the Gas Department to instal a gas-cooker and perhaps, after only two or three months' residence in the house, removes to another house and repeats the application. Should the new tenant who comes into possession of the first house require a cooker, there is little or nothing to complain of. But it frequently happens the tenant does not desire a cooker, and makes the usual application for its removal; and, perhaps, shortly after the removal of the cooker, we receive from the same tenant an application for a smaller cooking apparatus, such as a range plate, griller, or boiling ring. Being a municipal-owned undertaking giving out and fixing cooking apparatus free of charge, these applications have usually to be given effect to, even although we strive by persuasion to get the tenant to keep a cooker once it is fixed in the house.

Another source of annoyance is the fact of tenants leaving houses provided with a cooker after only a short tenancy, and the incoming tenant finding that the cooker in the house has been left in a very dirty condition. In such cases, we are generally asked to remove the cooker and supply a clean one in its place; and if this request is not attended to immediately, it is not an uncommon thing to find the cooker has been disconnected by the tenant and deposited perhaps in the back yard. This is an evil in connection with our business which I am afraid has come to stay, and particularly in corporation undertakings supplying free cookers. The frequent changing of cookers, besides being an annoyance, is bound to add considerably to our distribution charges; and any remedy that can be found to lessen or remove the evil would be a boon to the undertakings affected.

The slot meter business in connection with these monthly lets is also more or less affected, as more frequent visits by the collectors have to be made to collect the money from the meters before the tenants remove; thus resulting in the frequent interruption of the collector's routine work, and also adding considerably to the book-keeping necessary in connection with this part of our business.

ASSESSMENT VALUATIONS.

There is another matter I desire to bring before you, and that is the present method by which assessors arrive at the valuation of gas undertakings for assessment purposes. The present system is to value gas supply undertakings on what is termed the "Revenue Principle," which was laid down and settled in the Court of Session by Lord Fraser in the Falkirk Gas Company's appeal case in the year 1883. Since the Falkirk case, there have been several decisions given in the Court of Session in regard to the manner of application of the principle then laid down; but, on the whole, the principle of valuing gas-works has not been altered. In applying the "Revenue Principle" to a non-profit earning gas

undertaking, such as are owned by local authorities, the common practice is to take the gross revenue or income of the undertaking, from which is deducted the whole year's working expenses, including the cost of manufacture and distribution of the gas, maintenance and repairs of works and distribution plant, tenants' rates and taxes, bad debts, administration and management charges, and any other outlays which might reasonably be expected to fall upon the hypothetical tenant.

Having deducted from the gross revenue the working expenses referred to, there falls to be deducted from the remaining balance 5 per cent. on "floating capital." The sum allowed as floating capital depends very much on the assessor, as I am not aware that any definite decision has been given on this point in the Scottish Courts, although in the Kirkcaldy Gas Appeal in 1905 Lord Low allowed a sum of approximately one-third of the approved expenditure. In making this allowance, Lord Low, however, did not give a decision on the point; so that as the law stands at present the fixing of the allowance is pretty much left to the discretion of the assessor. Some assessors only allow one-third of the approved expenditure, while others quite freely allow one-half, including the Government Assessor of Railways and Canals, who makes out the valuation of several important gas-works in Scotland. Another deduction that falls to be allowed is a deduction for interest on tenant's capital—being the sum that a tenant would require to provide to supply apparatus and plant to carry on the business of manufacturing and supplying gas. Such plant and apparatus includes meters, testing apparatus, furniture, tools, and other movable plant which a tenant would be expected to provide, and sometimes cooking and heating apparatus, which I will deal with later. The usual allowance made under this item is 5 per cent. on the accepted value of such plant. On making the allowances and deductions referred to, the balance represents the valuation of the gas-works for that particular year, although it is the common practice to add the valuation of the two previous years, which, divided by 3, represents the average valuation, and which sum is generally entered in the valuation roll.

Profit-earning gas undertakings or gas companies are valued on much the same lines as the non-profit earning concerns, with the exception that a distinction is made between landlords' and tenants' expenditure, and only the expenditure applicable to the tenant is allowed. The usual allowances are also made for interest on floating capital and tenant's capital; and, when these deductions are given effect to, a further deduction of 20 per cent. is made from the remaining balance for tenant's profits. The resultant balance is the valuation for the year, which is averaged over three years in the same manner as that of the non-profit earning undertaking.

The following statements will fully explain the method adopted by H.M. Assessor of Railways and Canals for Scotland in preparing a valuation of a non-profit earning gas undertaking. Statements Nos. 1 and 2 show the income and expenditure of the undertaking's revenue account; No. 3 shows the method of arriving at the valuation.

In the Edinburgh and Leith Gas Commissioners' appeal in the Court of Session in 1909, it was decided that non-profit earning gas undertakings were to be allowed the whole of their working expenses without making any distinction between the expenditure which should properly fall upon the landlord and that which should fall upon the tenant. But it will be observed from the valuation statement that this decision has not quite been given effect to, as the owners' rates and taxes as well as feu duties are not allowed as a deduction. The reason for this is that, after the decision referred to, the Edinburgh Assessor refused to deduct the owners' rates and taxes and feu duties; holding that, as these items were purely landlords' charges, they could not be allowed as a deduction. As a result of the Assessor's attitude on this matter, the Commissioners again appealed to the Court of Session in 1912 to get a decision on the points in dispute. The decision went in favour of the Assessor—the Court holding and supporting the Assessor's contention that, being purely a landlord's charge, they failed to be deducted.

The next matter calling for attention in the valuation statement is the item under the heading of tenant's capital. Meters are held to be tenant's plant, following the decision in the Kirkcaldy Gas Company's appeal case in 1905; but in estimating the value of the meters, many assessors treat the undertakings very unfairly. It is quite a common practice for assessors to take the capital expenditure on meters as shown in the balance-sheets, and from it they deduct (say) 5 or 6 per cent. of their value each year for depreciation, with the result that in a few years' time the value of the meters is written-down almost to vanishing point. You are all familiar with the fact that gas undertakings have to keep their meters up to a certain standard of efficiency, in order that they may perform their work accurately; and it seems most unreasonable that assessors should be allowed to depreciate the meters to almost any extent. It is also well known that gas undertakings frequently provide large numbers of meters out of revenue; and by taking the expenditure on meters as shown by capital account the assessors naturally do not include large numbers of meters which belong to the undertakings, and which do not appear in their capital accounts. Another item that is often omitted is the cost of fixing the meters, which should properly be added to the cost of them for valuation purposes.

The Assessor of Railways and Canals, however, treats the meter question with more fairness, as he does not take the capital value of meters from the capital account, but requests a return showing the number and sizes of all meters belonging to the undertaking. Having been provided with this information, he estimates the value of the meters by taking their purchase cost *plus* a reasonable sum for fixing, and having arrived at the total gross value he deducts a standard depreciation of 25 per cent.; leaving the net value of the meters from year to year at 75 per cent. of their original cost. I consider this method of the Railway Assessor most fair and reasonable; and, perhaps, having

No. 1.—REVENUE ACCOUNT.

INCOME.

1. Sale of gas			£11,103 11 2
2. Residual products—			
Coke	£2,002 6 1		
Less wages and carriage	390 3 7	£1,612 2 6	
Tar	£674 9 1		
Less wages, &c.	38 15 9	635 13 4	
Sulphate of ammonia	£1,287 1 5		
Less wages, &c.	229 14 8	1,057 6 9	
Carbon	£4 12 3		
Less cartage	0 8 3	4 4 0	
			3,309 6 7
Total revenue			£14,417 17 9

No. 2.—REVENUE ACCOUNT.

EXPENDITURE.

1. Manufacture of gas—		
Coal, including carriage and wages	£1,376 16 0	
Benzol	33 7 0	
Purifying materials and wages	92 14 11	
Salaries of gas manager and of officers at works	505 0 11	
Wages of stokers, &c.	1,375 10 8	
Maintenance of works and manufacturing plant	910 15 1	
Other expenditure—cartage of refuse	28 18 4	
		£7,323 2 11
2. Distribution of gas—		
Wages of meter inspectors and collectors	£343 13 11	
Repairing of meters	129 7 11	
Repairs and renewals of stoves	254 5 0	
Maintenance of main and service pipes, &c.	313 12 2	
Gas fittings accounts	218 10 7	
Office cleaning	28 18 0	
		1,288 7 7
3. Rents, rates, and insurance (excluding property and income-tax)		1,393 17 10
4. General administration—proportion		158 16 0
5. Other expenditure—		
Stamps, stationery, and sundries		290 14 1
6. Discount allowances		2 11 6
7. Bad debts		16 17 4
Total expenditure		£10,474 7 3
Balance carried to net revenue account		3,943 10 6
		£14,417 17 9

No. 3.—VALUATION OF NON-PROFIT EARNING UNDERTAKING.

REVENUE—			
Sale of gas		£11,108 11 2	
Residual products		3,309 6 7	
		£14,417 17 9	
Less bad debts		16 17 4	
			£14,401 0 5
EXPENDITURE—			
Manufacture of gas		£7,323 2 11	
Distribution of gas		1,288 7 7	
Rents, rates, taxes, and insurance	£1393 17 10		
Less—			
Owner's rates, £486 8s. 2d. / Feu duties, £58 15s.	545 3 2		
		848 14 8	
General administration (proportion)		158 16 0	
Stamps, stationery, and sundries		290 14 1	
Discount allowances		2 11 6	
			9,912 6 9
Net revenue			£4,488 13 8
TENANT'S CAPITAL—			
Meters—estimated value		£7,967 0 0	
Stoves " "		4,883 0 0	
Furniture " "		233 0 0	
Testing apparatus "		276 0 0	
Other movable plant		433 0 0	
		£13,792 0 0	
Floating capital (half of working expense)		4,956 0 0	
		£18,748 0 0	
Allow 5 per cent. thereon for interest			937 8 0
Valuation for year			£3,551 5 8
Add valuation for two previous years (say)			8,250 0 0
			3)£11,801 5 8
Valuation (being three years' average)			£3933 15 3

brought this matter before you, many of you may be able to persuade your local assessors to adopt the same method. The estimated value of furniture, testing apparatus, and movable plant is generally ascertained by the manager of the undertaking supplying the assessor with a detailed statement showing the net cost of all articles and goods which come under these heads; and on the assessor satisfying himself that the statement is correct, they are included for allowance as tenants' capital.

Regarding the inclusion of the value of stoves in the tenant's capital, there exists a great diversity of opinion among assessors as to whether stoves can be legally included. This difference of opinion is due to the fact that the Kirkcaldy Gas Company, in their appeal in 1905, claimed the stoves as part of the tenant's plant; but Lord Low summarily dismissed the appeal on this point thus:

> I think the cost of cooking-stoves may at once be set aside, because it is not necessary for the carrying on of the business of making and supplying gas that the tenant should supply cooking-stoves. That is a branch of the business which he might or might not find it expedient to carry on.

As this is the latest Scottish decision on this point, assessors as a rule do not include the value of the stoves in the tenant's capital, although at the same time they generally allow the expenditure on the maintenance and repair of stoves to be deducted with the working expenses, following the decision in the Edinburgh and Leith case in 1909, when it was decided that all working expenses were to be allowed as a deduction. A later decision on this point has, however, been decided in the King's Bench Division of the English High Court of Justice, in the appeal of the Ipswich Gas Company in 1907, when Mr. Justice Channell (in whose opinion the two other Judges concurred) said:

> The question of law or fact was, what rent would a hypothetical tenant give for these premises which the gas company occupied? Was the Recorder right in putting money expended on stoves and fittings as tenant's capital, in respect of which an allowance ought to be made? His (Mr. Justice Channell's) answer was that if the receipts arising to the business from these articles were in fact brought into the account as profits of the business, then it was most certainly right to include them. The result was that both these things must be taken into account as part of the receipts of the business.

This decision I believe to be the correct view to take when the fact is considered that gas undertakings which provide these stoves greatly increase their revenue through the additional sale of gas due to their use; and I think it only just that, when assessors include the whole revenue of the undertaking from which they base the valuation, they ought to recognize the stoves as being part of the undertaking's equipment. Our position in Scotland is ruled, however, by the Kirkcaldy decision; and with the exception of the Assessor of Railways and Canals—who invariably treats gas undertakings in a reasonable manner—I only know of one other assessor in Scotland who recognizes stoves as part of the tenant's plant and includes them in the valuation under tenant's capital.

The present system of arriving at the valuation of gas undertakings is far from satisfactory, and in many cases the system acts very oppressively—especially on undertakings which are heavily capitalized. In addition, the system practically penalizes their commercial activities, as any surplus revenue which stands to their credit after meeting the usual standing charges goes to swell the valuation, with the inevitable result that at least one-third of such surplus revenue is lost to the undertaking in taxation.

Some time ago, through the courtesy of many of you, I received information enabling me to compile a statement showing the comparative valuation of several municipal gas supply undertakings in Scotland.

Comparative Valuation of Municipal Owned Gas Undertakings.

Undertaking No.	Capital.	Gas Made Per Annum.	Valuation.	Valuation per £100 of Capital.	Valuation per Million Cubic Feet of Gas Made.
	£	Cubic Feet.	£	£ s. d.	£ s. d.
*1	4,059,546	7,732,914,000	165,995	4 1 9	21 9 3
2	2,245,134	2,096,346,000	112,506	5 0 2	53 13 4
3	384,673	924,542,000	24,804	6 8 1	26 16 7
4	366,806	994,177,000	23,393	6 7 6	23 10 6
*5	200,432	523,893,000	14,950	7 9 2	28 10 8
6	249,722	395,074,000	13,800	5 10 6	34 18 8
7	246,410	245,646,000	10,122	4 2 1	41 4 1
8	212,071	211,100,000	9,260	4 7 3	43 17 8
*9	127,328	204,727,000	6,150	4 16 7	30 0 8
10	141,219	159,660,000	6,115	4 6 7	38 5 9
11	84,535	160,066,000	5,997	7 1 10	37 9 7
12	100,949	111,296,000	5,500	5 8 11	49 8 4
13	53,242	120,492,000	4,236	7 19 1	35 3 0
14	49,700	79,000,000	3,900	7 16 11	49 7 7
15	60,228	71,310,000	3,488	5 15 9	48 18 4
16	61,196	91,276,000	3,008	4 18 3	32 19 3
17	53,323	74,264,000	2,342	4 7 10	31 10 10
18	74,000	115,585,000	1,866	2 10 5	16 2 9
*19	33,841	150,736,000	1,842	5 8 10	12 4 4
20	58,490	95,466,000	1,510	2 11 7	15 16 2
21	46,775	65,347,000	951	2 0 8	14 11 6
22	21,427	58,241,000	810	3 15 7	13 18 1

NOTE.—The valuations marked with an asterisk were prepared by H.M. Assessor of Railways and Canals.

It will be observed that in the application of the valuation system there exist great discrepancies in the valuations, both as regards the valuations per £100 of capital and also per million cubic feet of gas made, which clearly demonstrates that there is lack of uniformity in the application of the system. Gas undertakings have a real grievance in having so iniquitous a system of valuation imposed upon them, when it is considered that other industrial concerns, such as engineering works, mills, &c., enjoy a much more equitable one, regardless of their earning capacities. Time will not permit me to deal further with this subject; but in bringing it before you to-day, I hope I may have aroused an interest in the question which may ultimately benefit some of you, as I have reason to believe that many assessors in Scotland do not give full effect to recent favourable decisions in the Courts in connection with gas valuations.

In conclusion, I may add that in Airdrie during the past three years we have saved in taxation a sum of approximately £800 as a result of giving the valuation question our most serious attention.

DISCUSSION.

Mr. ALEX. YUILL (Dundee) said, before entering upon the discussion, he wished to associate himself with the remarks made by the Chairman on the loss the gas profession had sustained in the death of Mr. Blair, who had played a great part as a constructive engineer and pioneer in the newer developments of gas manufacture. He was sure it would be their desire to leave behind them a memory so revered as was his. He complimented Mr. Currie both upon the matter of his address and upon the way it had been put before them. At the present time he admitted that they were suffering under great difficulties; and the matter of coal supplies was not the least of these. They hoped that this difficulty would pass away and brighter days shine again. He had taken some little part in the question of coal supplies before the President of the Local Government Board. Those who had had any experience of Government departments must have realized that they did not often get all that they asked for. But they could be assured of this, that the way in which the matter had been put before the Local Government Board had borne fruit. The Board realized the importance of maintaining supplies of coal for gas-works purposes. Several works were asked by the Board of Trade to give returns each week as to the amount of coal that they received, the quantity they used, and the stock they had at the end of each week. This showed that they were still attending to the business. He was very pleased to say that their position had changed a little for the better. Most of them experienced the maximum difficulty at the end of December, and since then things had bettered themselves. The lessened requirements, together with the lessened demands made by the general public, would allow them to lay in stocks of coal for the ensuing winter. With regard to the question of the stoppage of exports, this was a matter they had taken up. It was a selfish view to take, that they should veto the export of coal. On the broader view, they were forced to realize that it was almost unworkable. The export of coal could not be stopped. What, for instance, would be the advantage to the kingdom of Fife? About 80 per cent. of the coal raised in Fife was exported. If the exportation of coal was stopped, the industry of Fife was stopped. These facts were known to the Government. It was mentioned that they were agreeable to allow export if it were confined to our Allies. But this was an extremely difficult question. In fact, the Government could not face the position; they must make the best of the situation as it stood. In regard to the remarks in the President's address on a standard coal specification, there was one point they ought to keep before them. No matter what specification was prepared, it would never prevent one from sometimes getting a waggon of inferior coal. They could not say to the coalmaster, "You must pass all the coal we require through a good size of screen." If the coalmaster gave them samples of the coal that he was prepared to supply, and if this coal was suitable for the purpose, it lay with gas managers to see that the master fulfilled the contract according to the sample sent. He had had a specification; but such a specification he never looked on to give all the benefits claimed under the Chairman's remarks. If they obtained a sample of suitable coal, they should retain it, with the analysis, and see that the bulk was in accordance with the sample. If members considered that it would be an advantage for them, and they would like to have a model specification, he thought it was a matter that could be left with the Commercial Sections. According to the statistics the President gave, there were 75 members in connection with their Commercial Sections, most of whom attended. It was a matter to be debated in conference together. He thought better results would be arrived at by bringing the matter either before the Eastern or Western Section to be dealt with. They derived great benefits from conferences together, and he had no doubt that if the subject were brought before the Commercial Sections in their conferences from time to time they might be able to evolve some good from it. There was one feeling he had as to the difficulties mentioned with regard to free cookers. They all of them had difficulties from the time they purchased the coal until they showed their balance, either debit or credit, to their Directors at the end of their year. These were difficulties that they must face and lessen as much as possible. As to the House Letting (Scotland) Act, they could not get over this. The Act was there, and, in conference, what they

said would not lessen the difficulties; they must just surmount them as best they could. They served the public; the public did not serve them. They must accommodate themselves to the public. He considered that the principal part in the address was the question of the assessable values of gas undertakings. This was pretty well stereotyped. They knew the local aspects of the position. The table Mr. Currie had given was a suitable guide to those who were not conversant with the subject. The statement showing the comparative value of municipal undertakings was instructive. Some of them were able to pick from these figures and to spell the name of their own town. If they took the case of No. 2, they knew exactly where this was. They understood the reason why the capital was so high. Let them look at another case—No. 19. He took the capital per million feet—it was £224 per million; in No. 2 it was £1071. If they took the case of a works with a low capital, undoubtedly their valuation would be less. With a large capital they had interest and sinking fund to meet on the capital, and the aggregate of these charges together went to swell the valuation. They must have an income sufficient not only to pay for the gas and its distribution, but also for their interest and sinking fund. If they took an imaginary company with no interest and sinking fund to meet, in this case there would be no charge made on the gas to cover these charges. The valuation would be lessened to this extent. In the case of No. 21, the valuation per £100 of capital was £2 os. 8d. If they worked out the gas make per annum, together with the capital, they found that it came to £715 per million. If they took No. 19 —at £224 per million—the valuation for £100 of capital was low in No. 21 and more than double in No. 19. The conclusion was that in No. 21 they must be carrying a good deal of renewal expenditure to capital instead of to revenue. The figure of No. 19 showed clearly that they were carrying against revenue considerable amounts that could be put to capital. When they considered the condition of any company, if they wished to conduct it on sound financial lines, they should carry all they possibly could against revenue.

Mr. WILLIAM WILSON (Falkirk) said they should take a leaf out of Mr. Currie's book and thoroughly investigate the question of assessment. In his own case (Falkirk) they were very heavily taxed, and the effect was most apparent. The Assessor, in taking out his assessment and arriving at the valuation, gave them the benefit of an average of five years. They had built a new gas-works, and had added £90,000 to their capital expenditure. They had to raise money to pay interest on sinking fund; and this put up the valuation. The full effect was not felt for about five years. In 1907-8, they paid about 3·1d. per 1000 cubic feet in rates and taxes. Last year they paid 4·47d. It took a bit of doing to keep the price of gas steady, and pay so much extra in the way of rates and taxes. He was convinced that thay should pay everything out of revenue as they went along. Let them not allow capital to accumulate. They had most unfortunately in Falkirk certain members of the Town Council who did not object to the gas-works paying a big sum per annum in the way of taxes. This helped to keep down the general rates of the burgh. He was much amused at Mr. Currie's remarks as to changing cookers. They had to face this. They had a case recently where a consumer wanted a new cooker; and when they went to the premises it was found that there was a griller beneath the bed. The question of coal supplies was really serious. Their predecessors had been up-against it too. He did not think they could do much more than they were doing. They might draw up specifications; but, as had been stated, they would always get a waggon of bad coal, and if they were in desperation for supplies they had to "wink the other eye." As to washed coal, there was a disposition to buy water; and one did not get much gas from water. In winter time snow was absorbed in the waggon; and there was no allowance made for water. He had not come across a colliery that made such an allowance. In their case there was no allowance made for water in coal.

Mr. G. R. HISLOP (Paisley) remarked that he had listened with pleasure to Mr. Currie's address, which opportunely presented certain important matters which were confronting them. With regard to the difficulties, there was already a rift in the clouds; and he hoped they would soon get things restored. The President made reference to the matter of valuations and the anomalies attaching to them. It was truly a very notorious thing that they should accept the conditions, and that there should not be a uniform system of dealing with the matter all over the country. With regard to stoves, it was ridiculous to take up the position that they are allowed as parts of the tenant's capital. They were really revenue producing portions of the plant, and they should be included. The position taken up by Mr. Justice Channell was wise and sensible. It was difficult to get powers to put matters in the shape in which they should be and simplify them. Having one system here and another there was distressing. The address should give rise to much thought. It should be of great use to the members, particularly with regard to valuation.

Mr. J. B. SCOTT (Cowdenbeath), the President of the North British Association, held that the President had put before them some of the most troublesome questions that worried the gas manager. The coal difficulty to some—those in the vicinity of the coal pits had not been troubled so badly—had been serious the last few months. It was sought to improve this by the adoption of a standard coal specification. The difficulty that appealed to him was that coal was not a manufactured article. The fact that the coalmaster had to take the coal from the mine just as he found it, went a long way against a standard specification. It was well known that all seams of coal varied a little backwards and forwards. A sample might be obtained drawn from one part of the seam, and after a year the quality of the coal might vary a good deal. Who was to regulate the value of it? Supposing a specification allowed that the price was to rise and fall with the varying quality of the coal. Who was going to decide? It would have to be on a sliding-scale principle, and this would be a difficulty. Nevertheless, coalmasters could be tied-down to better deliveries. On the subject of cookers, it might be that there was more trouble where they were supplied free. The more the consumer secured, the more he generally wanted. In their case, if a consumer had a cooker supplied free and did not use it, it was taken away. But they could not do this if it was hired. He also had spent a good deal of time on the valuation question. The subject of gas-cookers as part of tenants' capital was interesting. They, in West Fife, were allowed gas-cookers. He had to deal with two assessors. The assessor for West Fife allowed gas-cookers as part of tenants' capital; while the assessor on the other side did not. In the end, the only way open was an appeal to the Court of Session. He thought there should be a combination of all gas-works in the country. It was unfair for one undertaking to have to go forward and fight a case, and that others should get all the advantage of their doing so. If there was to be any test-case at all, it should be the result of combined action. He questioned the charging "as much as possible" to reserve. Could not this idea be overdone? They all liked to charge as much as possible to revenue; but, he asked, should the gas not be reduced instead, and the present-day consumer be given the benefit, in place of building-up a works out of revenue to go to the credit of future consumers?

Mr. WILLIAM WILSON (Falkirk) said the last time they were in London in connection with borrowing powers, they had great difficulty in getting what was really wanted. The Scottish Office insisted upon them repaying their capital in a shorter period, and paying into a reserve fund 2d. for every 1000 cubic feet of gas sold, until the fund stood at £25,000. On the other hand, the authorities said, "We will allow you to pay for any new apparatus out of the fund." This was, of course, practically taking it out of the revenue. The only things they were not allowed to pay for were new cookers and new meters. These must be directly charged against capital. Thinking it over, he (Mr. Wilson) believed Mr. Scott would be convinced that he should do as much as possible in this way.

Mr. SCOTT: Does the assessor take into account the sum you pay into the reserve?

Mr. WILSON: We are taxed upon what we pay into the reserve fund. We pay for it through the nose.

Mr. YUILL explained, in connection with the position at Kirkcaldy, that he had had some experience with assessors, and they had allowed the sum expended on cookers as tenants' capital, and had admitted that the position at Kirkcaldy was not on the lines of equity.

Mr. SCOTT: In this case in the East of Fife, where they do not allow gas-cookers as tenants' capital, they deduct from the revenue the stove-hire. The stove-hire is about equal to 5 per cent. on the cost of the stove; so we do not lose anything by it.

Mr. A. C. YOUNG (Arbroath) contended that the trouble over assessments was a small thing. What money was obtained from them by way of assessments went back to the consumer in the way of rates, and thus reduced the amount required from the ratepayer. What he was disappointed about in the discussion was that little or nothing had been said about the imposition that was made upon them by the coalmasters. Their sons and brothers were fighting in France and elsewhere, and they found the unpatriotic financier and capitalist attempting to "rob" the working people. The working man had to pay the increased price of coal. His (Mr. Young's) Committee had just received tenders for twelve months' coal, and the increase in the price of gas made from coal would be 34 per cent. He was sorry to hear what Mr. Yuill had stated regarding his journey to London. From what he said, they were to take all this lying down; and as an individual he must accept this position. But as a body of large users of coal were they all to accept the position?

Mr. DAVID VASS (Perth) felt that a rather rosy view was being taken as regarded coal. The feeling with most of those in close touch with the market was that the end of the war would not see the end of big prices, and that they were—for the whole twelve months in front of them—likely to be faced with shortage of supplies as well as high prices. There was a slight tendency at the moment to fall back. This tendency showed that the price was bolstered up in the West. In the East the price did not go up to quite the same extent. He thought that the remedy of reducing exports was the only effectual step towards keeping down prices. This, of course, must be left to "the powers that be." The question of the increase in price would mean 6d. per 1000 cubic feet on the gas. Why should the present generation bear the whole burden of this 6d.? It had been suggested that they should raise their prices one-half of this amount, and spread the increase over two or three years. Another remedy was that they should seek relief from the Government in the matter of their sinking funds. In the case of companies, they could lay aside a sum for the reserve; but very few corporations were allowed to do anything of the kind. Their Acts made them keep their gas at a minimum price. It would be possible for the powers that made their Acts to repeal the Acts for the time being,

and allow them for one year to forego paying into the sinking-fund. In many cases, the sinking-fund was an invested fund. He thought that an agitation should be started for corporations getting relief in this way, and so passing on the burden to a future generation. He would like to hear a discussion on the effect of the exchanging of cookers. Was it, he asked, that abolishing hires caused the present pass—or would the system of hires overcome it? When hires were abolished in Airdrie, it was because they had cookers thrown upon their hands after the summer was over. He believed that the supplying of free cookers did not cause such a heavy tax on the community as did hiring. He would like to know, in regard to gas-works valuation, why a gas undertaking should be valued on its profits, and a millowner next door be valued on the structural value of his mill. This was where they should get an equalizing of ratings. He thought the new Act put into force a few years ago was leading in this direction. It would do away with the great difference between two undertakings that had the same output of gas and the same plant, but which—because the one had a capital double the other—were assessed at double the rate.

Mr. JAMES M'LEOD (Greenock) said he was particularly interested in the point in the paper referring to the increase in the demand for coke among householders. In Greenock he had secured a great increase by circularizing householders. He got about 750 circulars from the British Commercial Gas Association, and this developed the trade. If more of them approached the local demand among ordinary householders with greater energy than they at present did, there would be less of dumping coke at low prices in neighbouring towns, so as to get rid of it. Speaking of the method of valuation adopted in Greenock, he said that in their case an overhead average valuation of the meters was taken. They took the total number of meters in the town, and at the time of taking stock added to the total the number in stock. On the total, they took an average value of 30s. per meter. They came out fairly well so far as meters were concerned. They were, however, not allowed to include stoves in their valuation. He should have liked if Mr. Currie had made out in his table of the comparative valuation of municipal owned gas undertakings the gas sold per annum, instead of the gas made per annum. He (Mr. M'Leod) held that it should not pass the wit of man to devise some system of arriving at a valuation on a fair basis, whereby the enormous discrepancies often found would be wiped out.

Mr. CURRIE, in his reply, said he had expected the discussion to be much more critical. Mr, Yuill had kindly given his experiences in London in connection with the supply of coal. He (Mr. Yuill) mentioned that he thought the gas industry would not benefit to any great extent should the export of coal be prohibited. He especially mentioned about Fife, that 80 per cent. of the coal was exported. If the 80 per cent. of coal were available to the market, particularly in the West——

Mr. YUILL: In considering this question I quite admit that the majority would have been anxious to get the 80 per cent. But if they had given from the 80 per cent., it would not have been within 25 per cent. of their output; and the miners would not have been working more than two days in the week. In view of the amount of coal produced in Fife, if it were only for local demand it would swoop the whole markets, and still the men would not have sufficient work. One must consider the position as to how it affects the miners and the coalmasters.

Mr. CURRIE: At the present time the Committee of Inquiry have made the recommendation that the export of coal should be suspended.

Mr. YUILL: Not suspended—lessened.

Mr. CURRIE: I think by sending coal to Italy and other countries, we do not know where it is going. It is a shame that we should have to pay 100 per cent. more, and yet coal should be sent to other countries.

Mr. YUILL: You must not imagine I stand as an "*Advocatus Diaboli*." I only mentioned the position as it was placed before the Local Government Board.

Mr. CURRIE (continuing) said he thought there ought to be a specification describing the class of screen for the various classes of coal. One got coalmasters who took the chance of sending inferior coal, and who quoted a little cheaper just to get the business; and after they had secured it, the gas concerns had to suffer. He wanted to know of any gas manager who, since the beginning of last winter, had refused a waggon of coal.

Mr. VASS: I did; and I am suffering for it now. (Laughter.)

Mr. CURRIE said, with regard to change of cookers, that Airdrie was one of the first concerns to adopt a system of free cookers. Being a Corporation undertaking, it was within their power to refuse a cooker to a consumer who had played a trick upon them. But, unfortunately, the consumer had only to go to his ward representative and demand a cooker, and there was a rumpus if he was not satisfied. He had brought up the question that afternoon to see if there was a remedy for the evil. Like all of them, he was dissatisfied with the present system of valuation. Mr. Yuill had pointed out that it was a case of how their capital account stood as to the amount put on for assessable valuation. Let them take a gas company that sold its undertaking to a corporation at a big price. In Airdrie, they were still suffering from the high price paid. It seemed absurd that when an undertaking was oppressed by high capitalization, it should therefore also be oppressed by high taxation. It seemed that the harder the position with regard to finance, the more was put upon a gas undertaking. Mr. Young mentioned that it really did not matter whether they paid large sums in rates and taxes, because it all went back to the consumer. This might be quite in order if the whole of the rates and taxes were paid within the burgh. But in some undertakings, they paid within other areas. And in many towns they had electricity competing against them. What about the electrical consumer, if the gas consumer had to pay the extra expenditure in rates and taxes? The electricity consumer would have an advantage that should not be.

A Valuation Committee Appointed.

Mr. J. W. NAPIER thought as business men they ought not to allow the matter of valuation to rest. It ought to be made clear that, in the matter of the valuation of gas undertakings, there was no law, and that precedent, together with decisions of the Court of Session, had determined the basis of valuation. There should be a principle upon which gas-works were valued—having regard to other similar industrial undertakings. For example, they found an engineering works spending £5000 in putting down new machinery, while their assessable value remained the same. With a gas-works, if they put down new plant, by reason of the extra dividend payable, together with capital charges, they found that their valuation was increased. The complaint they had to make as representatives of gas undertakings was the unfair method —or rather the want of principle—by which they were treated compared with other industrial undertakings. It appeared to him that this matter should be taken up immediately. He suggested that a few members should be appointed to form a Special Committee to deal with this particular subject, and their duty would be to thoroughly sift the matter. The Committee would draw up a report and present it to the North British Association Committee for their full consideration. Proper representations should be made to someone in authority—it might be to the Secretary for Scotland or direct to the Government, through some of its departments. He hoped that they were in sympathy with his suggestion.

Mr. S. B. LANGLANDS (Glasgow) supported Mr. Napier. If only they could get on to the same basis as railways and canals, where special allowances were made for special subjects, he thought it would be in the right direction.

Mr. A. WADDELL (Dumfermline) seconded the motion.

The following Committee was then appointed: Mr. Scott, the President of the North British Association, Mr. Currie, of Airdrie, Mr. Yuill, of Dundee, Mr. Alex. Wilson, of Glasgow, Mr. Waddell, of Dunfermline, and Mr. Napier, of Alloa.

Mr. YUILL: I presume that the motion is to the effect that the co-opted members work in conjunction with the Committee of the North British Association?

Mr. NAPIER: No; a Special Committee to report to it.

Mr. YUILL: This Committee have no power to incur any expense. Could they not get the co-operation of the North British Association to assist in the matter?

Mr. WILSON (Falkirk): What about the gas companies? The present system of assessing will eventually bring the corporations into a better position than the companies. I think the matter would be better left to the North British Association.

Mr. M'LEOD: A few years ago I made a motion that this meeting should become amalgamated with the North British Association. I find now that the constitution of this meeting has quite changed. If the constitution of the Informal Meeting is solely its name, its name has been changed, and therefore its constitution has been changed.

Mr. YUILL: It has no constitution. The name is "Informal."

Mr. NAPIER: The name remains—"Scottish Gas Managers."

Scotland and the "B.C.G.A."

Mr. NAPIER referred to the British Commercial Gas Association. There had been, he said, a feeling that the Association had not been dealing out justice to Scottish Gas Managers. Mr. Mason, the Secretary, had agreed to bring before the Executive Committee the necessity of forming a Scottish Committee, which would ensure the matter being dealt with thoroughly and in its local aspect.

Next Year's Chairman.

Mr. NAPIER proposed the name of Mr. Alexander M'Kay, of Motherwell, for next year's President, and this was agreed to.

The Annual Dinner.

At the dinner which succeeded the meeting,

Mr. HANNA (Messrs. Stein and Co., of Bonnybridge), who is serving with the Red Cross Society, said, when replying to the toast of the "Services," proposed by Mr. Hamilton, of Glasgow, that the gas engineers of Scotland might provide a motor-car for the Red Cross Society at the front.

Mr. SCOTT, the President of the North British Association, said he was very pleased that Mr. Hanna had mentioned this matter. It should be put before the first Council meeting. He understood the cost was something like £450; and if the whole gas industry of Scotland—including the allied trades, meter makers, &c.—was approached, it would not take such a big subscription from each to secure for Mr. Hanna his desire.

At the meeting of the Royal Society of Arts on the 12th prox., Mr. Charles R. Darling, F.I.C., will read a paper on "Recent Progress in Pyrometry."

THE APPLICATION OF BYE-PRODUCT COKE-OVENS TO THE GAS INDUSTRY.

By J. D. Forrest, of Indianapolis.

[A Paper read before the Indiana, U.S.A., Gas Association, March, 1915.]

The widely advertised success of the Citizens Gas Company of Indianapolis in furnishing gas at the unprecedentedly low rate of 60 c. per 1000 cubic feet (more recently reduced to 55 c.) has drawn a great deal of attention to the bye-product coke-oven as an economical device for the production of gas. A great many managers of gas properties have given consideration to it; and a great multitude of people who have been attacking the gas companies have thought they have found in the bye-product coke-oven a solution for all of the problems connected with the price of gas. Since I was personally responsible for the adoption of bye-product coke-ovens by the Company which I represent, it has been assumed that I stand for this process of gas manufacture against every other for all classes and conditions of gas companies. It occurred to me therefore that it was my duty to the gas industry in general to present not only the advantages of bye-product coke-ovens for certain communities, but also the reasons why they are entirely unsuitable for a larger number of communities. It is not my purpose to deal with the technical side of the bye-product coke-oven, or to lay before you any long array of statistics; rather, I desire to give to you my views on the broad proposition covered by the subject of this paper.

Coke-Oven and Coal-Gas Retort Compared.

For places for which the bye-product coke-oven is adapted, there can be no question that it is at present the most economical process of gas manufacture known. While the process does not differ greatly in principle from that of the ordinary coal-gas retort, the scale on which the operation of the plant is conducted gives it such advantages over the retort system that the difference becomes a radical one. The advantages may be enumerated briefly.

In the first place there is great economy in carbonizing in bulk. Instead of using a chamber containing a few hundred pounds of coal, the coke-oven may receive a great many tons—the largest and most modern ones running up well above 15 tons. The labour of charging these ovens, and of discharging and handling the coke, is practically the same, regardless of the size of the charge. While the mechanical equipment must be vastly more expensive than that required for coal-gas retorts, and the cost of maintenance must consequently be greatly increased, the direct labour of operation is reduced almost to a vanishing point as compared with the labour required for carbonizing the same tonnage of coal in ordinary retorts.

Another important advantage is that the quality of coke is much superior to that produced by retorts. It is true that this is due to a certain extent to the selection of better coking coals—the gas yields being to some extent neglected; but even with the same coals that are used in good bye-product coke-oven practice the retort could not produce as good coke. The bye-product coke-oven admits of better regulation of the heats, and the mass of the coal, together with the strength of the oven construction, permits the use of a slightly swelling coal mixture which will result in a much denser and stronger coke than the retort can produce.

This superiority of the coke means a better and also a wider market for it. It is a better domestic fuel, and ordinarily commands a higher price than gas-house coke. But it is also so well adapted to foundry and blast-furnace purposes that it usually commands a premium over the best grades of beehive coke. Bye-product coke is rapidly displacing beehive coke, and is doing so by commanding a higher price, instead of a lower one. By this ability to provide coke for a wider range of uses, the bye-product coke-oven must command a better market than the coal-gas retort. Not only is the local price certain to be better, but the value of the product, and its adaptability to numerous uses, enable it to stand transportation to very distant markets. This is an important desideratum; for the gas demand of almost any city must necessitate the production of coke, if the bye-product process is used, in excess of the coke demands for the same community. The Citizens Gas Company of Indianapolis could not exist if it were not able to market a large proportion of its output of coke at points hundreds of miles away from its ovens.

Fuel Economy of Coke-Ovens.

Granting a good market for a large volume of coke, the bye-product coke-oven is more economical than the retort from the point of view of fuel consumption. Coke is worth more to the domestic consumer, the foundry, or to the blast-furnace than it is to the retort. I mean by this that gas produced in the carbonization of coal is a cheaper fuel in the operation of the retort or coke-oven than coke produced from the carbonization of coal. While every bye-product plant has certain inferior grades of coke which may be used for its own fuel purposes, it may be taken as a general principle that it is more economical for the bye-product coke-oven to sell its coke and use part of its gas for heating the ovens, than to sell all the gas and use part of the coke for heating. The quantity of gas produced by the modern coke-oven is rather greater than the retort can produce from the same mixture of coal; but it is in the use of gas for heating the ovens that one of the great economies is found.

At our Langsdale Avenue plant a compromise method of heating is provided, which has certain advantages under certain conditions—namely, the heating of the ovens to a very large extent with producer gas generated from cheaper grades of coal. This, however, is designed rather for the sake of recovering the maximum amount of gas from a given number of ovens than because of economy as compared with the use of oven gas for the same purpose. Therefore it represents an arrangement for avoiding an enlargement of the coke-oven plant, and consequently the extension of the coke market, rather than economy of operation. With a larger capital investment and confidence in a wider market for coke, it would be more economical to enlarge the coke-oven operation than to heat the ovens with producer gas. I may add that half the ovens at our Prospect Street plant were constructed with a view to a possible future application of producer gas for heating purposes; but this also was done only because of our recognition of the limitations of Indianapolis as a coke marketing centre.

Separating the Gases.

When provision is made for separating the gases, whereby the leaner gas may be used for heating the ovens while the richer gas is sent to consumers, the bye-product coke-oven produces a much richer gas for distribution than the coal-gas retort—that is, a given standard of quality may be maintained without enrichment of the gas; and consequently economy of operation is found on this side also. At our Prospect Street plant, where the gases are separated, we are easily able, except in times of unusual emergency, to produce gas of a heat value considerably in excess of 600 B.Th.U. The average for the year 1914 at this plant was 630 B.Th.U. At our Langsdale Avenue plant, however, where the gases are not separated, it is very difficult to keep the average heat-value up to 600 B.Th.U.; and there are many occasions when it drops considerably below this figure. Nevertheless the gas produced at the Langsdale Avenue plant from a coal mixture averaging 29 per cent. of volatile matter averaged 599·27 B.Th.U. for the year 1914; and I venture to say it is a considerably better record than any coal-gas retort could make with the same coal. It cannot be claimed that bye-product coke-oven operations usually recover much more tar and ammonia than well-managed coal-gas plants; but they certainly recover larger percentages of these bye-products than coal-gas retorts could recover from the coal the bye-product coke-oven uses.

Advantages Summarized.

Summarizing the advantages of the bye-product coke-oven, we find that the labour cost per ton of coal carbonized is lower; the quantity, quality, and value of coke produced is higher; the fuel requirements for carbonization are more economical; the quantity and quality of the gas are better; and the quantity and quality of bye-products likewise are better than the best practice of coal-gas retorts can obtain. These are certainly advantages which indicate the adaptability of bye-product coke-ovens to the manufacture of gas for city distribution wherever conditions are favourable for the operation of such plants.

Reasons against Coke-Oven Plant.

However, this qualifying clause that I have used has so much significance to my mind, that I must devote the remainder of my paper to showing the reasons why bye-product coke-ovens are not well adapted to the purpose of gas manufacture for the great majority of gas companies.

The objection to the bye-product coke-oven which occurs first to the gas operator is the difficulty in disposing of the coke. When it was decided to erect bye-product coke-ovens in Indianapolis, the enterprise was derided, and every possible reason was given why the Citizens Gas Company was doomed to failure. The reason most frequently given was that it was impossible to sell the coke. It was urged that the quantity of coke produced to supply even the modest business which the Company first endeavoured to take care of could never be marketed, and consequently that the Company would soon be ruined. The fact that the Citizens Gas Company now control and operate the plant and system of the men who criticized the coke-oven project most severely, is the best proof that our judgment was correct when we decided to instal bye-product coke-ovens. Nevertheless, the force of this chief objection to the bye-product coke-oven must be recognized; and I desire to point out that the objection is even greater than appears on the surface. On the one hand, there are many small communities, or even cities as large as Indianapolis, which cannot possibly employ bye-product coke-ovens successfully because there is no market available for the coke; while, on the other hand, there are many large cities where the gas requirements are so vast that the production of sufficient coke to supply the gas consumers from bye-product coke-ovens would mean a volume of coke which in the present state of the demand could not possibly be sold. The bye-product coke-plant will obtain a much larger revenue from its coke and bye-products than it does from gas.

Financial Results.

Some idea of the relation of the two sources of income may be obtained from the following comparisons: In the year 1914 the

gross operating revenue of the Citizens Gas Company of Indianapolis was $2,548,346, of which $1,143,390 came from the sale of gas, and $1,404,956 from the sale of coke and bye-products. During the same year the Consolidated Gas Company of New York had a gross income from its gas department of $25,500,000, of which $23,200,000 came from the sale of gas and $2,300,000 from the sale of coke and bye-products. No reference is made in either case to non-operating income, and no reference is made to the electrical business of the Consolidated Company. With a total gas income over twenty times as great as that of the Citizens Company, the Consolidated Company derived an income from the sale of coke and bye-products less than one-and-two-thirds times as great as the income of the Citizens Company from that source. Athough the coke consumption in territory tributary to Greater New York is enormous, the Consolidated Gas Company could not possibly have produced all the gas to meet the requirements of New York from bye-product coke-ovens, because it could not have sold the coke. It is only when a market for the coke can be secured that a gas company can venture to look to the bye-product coke-oven for its process of manufacture; and it must be admitted that in the vast majority of cities in this country this difficulty alone is sufficient to prevent the introduction of bye-product coke-ovens. This is only one aspect of the problem regarding coke and bye-products. I shall recur to this subject after mentioning other important reasons which must prevent the average gas company from installing bye-product coke-ovens.

Large Outlay Required for Plant.

One such reason is the investment required for the plant. In many communities it would be impossible to have gas at all if it could not be produced by water-gas plants; and this altogether apart from the question of the sale of coke. There are many communities that could not stand the capital charges required for installing coal-gas plants. Manifestly, then, it would be impossible to consider bye-product coke-ovens for such places. Now the cost of installation of a bye-product coke-oven plant over a coal-gas retort plant of the same gas capacity is greater than the cost of a coal-gas retort plant over a water-gas plant of the same gas capacity. Everything about a bye-product coke plant must be built on a large scale. It is not only necessary to make the individual chamber that is to receive the coal large and expensive, but there must be a considerable number of the chambers in order to obtain economical results; for a large battery of ovens can be operated with the same number of men that would be required for three or four ovens. Therefore it would not be profitable to instal bye-product coke-ovens unless a considerable tonnage of coke could be produced every day. I am inclined to think that the initial construction of the Citizens Gas Company in this city was as small as it would be possible to operate with any particular economy, and this construction provided for a carbonizing capacity of nearly 500 tons of coal per day. Not only must the ovens themselves represent a heavy investment, but all the machinery connected with the ovens—the condensing house and bye-product recovery equipment, and the yard facilities of such a plant—must be large and costly. It is quite evident that not many gas companies can afford to instal such equipment to meet the demands of the communities which they are serving. In order to operate such a plant at all, it must have a considerable volume of gas business, as well as a market for its coke and bye-products. While conditions may differ in different places, I am inclined to the view that a bye-product coke-oven plant is not well adapted to any community which requires less than a million cubic feet of gas per day.

In connection with the capital investment required by a bye-product coke-oven plant, we must bear in mind the fact that most communities have gas plants representing a considerable investment, and operated as going concerns for the benefit of their consumers. While I make no defence of any concern that would allow its equipment to get out of date, and would not take the position that a community must go on for ever paying interest charges on an expensive plant which might be superseded by a more efficient one, we must recognize that the bye-product coke-oven process is comparatively recent, and that the problems connected with its application to given communities are exceedingly complex. The condition of the art of gas manufacture has not yet reached the point where a community can justly demand that a modern and well-equipped gas-retort plant or water-gas plant should be "scrapped" in order to admit of the construction of bye-product coke-ovens. Even where a situation renders the installation of a bye-product coke-ovens advisable, the existence of a perfectly good plant that was constructed in good faith by men who took all reasonable account of conditions at the time, must often preclude any consideration of bye-product coke-ovens. If a bye-product coke-oven plant could be tacked on to existing gas plant with comparatively little additional expense, it might often be considered; but in view of the immense investment required for a proper plant of this character, and in view of the existence of a good plant of another type built in good faith and with the exercise of reasonable care, the community has to be satisfied with what it has already obtained—at least, for a reasonable period. Otherwise, in all fairness, the company must be allowed to earn a reasonable return, not only on the bye-product coke-ovens but on the plant discarded long before its usefulness was ended. In these circumstances the increased interest charges would probably more than counterbalance the economies from the bye-product coke-oven operation.

Extent of the Coke and Products to be Handled.

There is a further important consideration growing out of the large volume of coke and bye-products to be handled, which is sufficient to cause a decision against bye-product coke-ovens in a very large number of cases. A public utility is usually conceived to be organized to provide some definite public service. The problem of serving the public is itself so complicated that those who are engaged in discharging the duty seldom care to undertake large additional responsibilities that amount to the same as the management of other enterprises not essentially connected with the public utility proper. The ideal method of providing gas for a community is by a water-gas plant, which can furnish gas and at the same time throws upon the management no duty not immediately connected with the public service, except that of disposing of an inconsiderable bye-product in the form of water-gas tar. It is recognized that there are many places where coal-gas plant can properly be installed for operation in conjunction with water-gas plant, primarily on the ground that the water-gas plant will consume the greater part of the coke. A considerable step beyond the operation of a public utility proper is taken when a coal-gas retort is the sole source of supply of gas; for there is then thrown upon the management the burden of a very considerable industry outside the public service proper.

However, if the coke produced can be absorbed by the community served by the gas company, the task is simple, because the company can use its organization to a considerable extent in selling the coke. Now when the final step is taken of installing bye-product coke-ovens as a source of gas supply, an entirely new industry is brought in, large enough and complex enough to demand the entire attention of the management, without having it connected in any way with the duty of meeting the peculiar conditions surrounding the supply of a public utility. A bye-product coke-oven plant is a large manufacturing concern. As I have already pointed out, the Citizens Gas Company of Indianapolis derived more than 50 per cent. of its gross revenue in the year 1914 from business other than the sale of gas. I must remind you that the Company produced in the year 1914 over 250 million cubic feet of water gas, chiefly during the first three months, when the Landsdale Avenue coke-ovens were either not in commission or else were operated to a limited extent because they were just being completed and put to use. A normal year for the Citizens Company would mean a still larger proportion of its gross income from the sale of commodities other than gas. The problem of meeting market conditions for these products is itself a large one.

The Coal Supply Question.

In addition to the sales' end of the coke and bye-products business, the problem of coal supply becomes one of a magnitude never realized by any gas operator as such. It is no longer a question of getting a certain tonnage of coal with a certain average volatile matter—such as the manager of a gas plant must meet; it is a problem of buying a coal which first of all will produce good coke of the kind for which a market is in sight. Secondarily, this coal must produce gas and bye-products. But the enterprise will be a failure unless the quality of coke can be maintained at a high standard. Now the coals available for gas-making are much more numerous, and more easily located, than those available for high-grade metallurgical coke. The coals purchased by a bye-product coking company must be selected with a good deal of care from a somewhat limited area, and must be bought at prices which can be afforded in view of the coke market. Here are large questions which the manager of a gas plant never meets at all.

Problems of Manufacture.

Aside from the question of the purchase of coal and the marketing of coke and bye-products over a wide area, the problems of manufacture likewise add very greatly to the responsibilities of the management. Failure to maintain the proper heat conditions in a coal-gas retort may result in a smaller yield of gas or bye-products; but failure of the same nature in the operation of a bye-product coke-oven may mean the same relative loss in gas and bye-products, as well as the production of an immense amount of coke which cannot be sold at all. I do not want to magnify the difficulties of bye-product coke-oven operation, but I am positive in my view that they are such as the manager of a gas plant is practically never required to meet. In other words, a bye-product coke-oven plant is a large manufacturing concern, the operation of which bears very little resemblance to that of a gas-plant proper, and the product of which is subject to the vicissitudes of general business which touch the gas industry only to a limited extent.

Now it may be a question whether it is right to throw upon the management of a public utility these diverse duties. The public is exacting and uninformed; the business of the distribution of gas is subject to a great many peculiar difficulties, requiring close attention; the problems of meeting the needs of the public, and of extending the business, are peculiarly harassing. It may be doubted whether the organization of a gas company can very often be made adequate to take care of all these duties of the public utility company, and at the same time manage a great manufacturing concern. Certainly this cannot very well be accomplished by a company whose organization must be small because of the size of the community; and, even if the city is large, there may very often be conditions which would render it unwise to bring the management of these two diverse enterprises within one organization. By this statement I am not confessing

that the Citizens Company made a mistake in adopting the bye-product coke-oven process of gas manufacture. If I had the whole history to live over again, I should still consider it the only method by which the Company could have been made a success. We have no regrets because of our choice. However, I will say that the responsibilities which I voluntarily, but perhaps rashly, assumed are such that a prudent man should not take upon himself without mature deliberation. While I do not regret the choice which our Company made, or the labour involved in accomplishing our purpose, I can say that once in a lifetime is often enough for a man to undertake such harassing responsibilities; and, so far as I might be personally involved in the undertaking, Indianapolis would not have 60-cent gas if the job had to be done over again.

This does not mean that the bye-product coke-oven should not be used extensively for the supply of gas for city distribution. I simply mean that the gas company should buy gas from the bye-product coke-oven plant, rather than undertake to operate the bye-product coke-oven plant itself. This is not a new conclusion on my part; for I saw all the implications of the union of the two industries at the time the Citizens Company decided to instal coke-ovens. The conditions of organization and finance had made it impracticable to separate the two interests in our case. It was wise to combine them, because it was only by this means that the result could have been accomplished. Except for these special conditions (which seldom apply in other cases), it would be far better to let the manufacturing industry take care of itself, and the public utility take care of itself, with no relation between the two except a contractual one, which should be mutually advantageous. I believe there are many points where bye-product coke-ovens can be established advantageously, and where the gas produced by them can be used for city distribution. But I do not believe that the community or the gas company is often justified in assuming the risk and responsibilities of the bye-product coking business; nor do I believe that the bye-product coking enterprise is justified in bringing itself under the limitations and the special difficulties of the public utility.

The Ideal Arrangement.

The ideal arrangement is one under which the bye-product coke-ovens can sell all their surplus gas to the gas company, but where the consumption of gas is in excess of that supplied by the bye-product ovens. Under these conditions a gas company would operate its own water-gas plant and secure great economies by purchasing a large proportion, but not its total requirement, of gas from the bye-product coking company. The latter company would then be under no rigid regulations with reference to the calorific value of the gas; while a gas company, through the operation of its water-gas plant, could keep the gas up to the standard established by law or by its own practice. The management of the gas company could devote itself entirely to the problems belonging to a public utility; while the management of the bye-product coking company could devote itself to the large manufacturing and selling problems which must always confront the industry. The peculiar conditions in Indianopolis rendered the complete amalgamation of the two industries a necessity. Voluntary assumption of the risks and responsibilities of operating a coking plant—as, for instance, in the case of the Laclede Gas Company of St. Louis—is, I believe, unwise.

Another Possible Trouble.

Following to their logical conclusion the ideas I have just expressed, about the diverse character of the two industries under consideration, I call your attention to another problem which has probably not yet arisen with any gas company, but which is bound to be a serious one where bye-product coke-ovens are used. I refer to the attitude of public service commissions or other public authorities toward the question of rate-making. The law which seeks to regulate the rates of public utilities is based on the assumption that the business provided by a community is relatively stable, and that the risks of the business are reduced to a minimum. In these circumstances it is possible for a conscientious and intelligent regulating body to establish rates which will yield a reasonable return on the investment in the public utility. The element of risk is taken into account to some extent, and the rate of return on the investment is justly recognized as being different under different conditions. Nevertheless, the determination of a reasonable rate of return on the investment in a bye-product coking industry involves so many problems in no way connected with the ordinary questions before public utility commissions, that it may be doubted whether such commissions are likely to be in a position to give the subject proper consideration.

It is not hard to determine what is a reasonable allowance for the fluctuations in the cost of manufacturing gas in an ordinary plant, or for the variations in the expense of distributing same. But here is a large manufacturing industry whose income on its investment in the manufacturing plant proper is derived to the extent of perhaps 75 per cent. from a business in no manner connected with gas. For purposes of rate-making, it is necessary to take into account a reasonable cost of gas in the holder, and add to it the cost of distribution, sale, and management; and then make proper allowance for interest on the investment in this somewhat stable industry. What public service commission would care to take upon itself the determination of the proper marketing of the large output of a bye-product coke-oven plant, and what one is likely to be in a position to measure the hazards of business for such a plant? I do not say it cannot be done, and I do not say a wise and just commission would not allow a return on the investment in such an enterprise far in excess of what it would deem reasonable for the gas business proper. But it is evident the problems before a commission which sought to pass on such a question would be entirely dissimilar to any confronting a commission deciding the mere question of gas-rates.

On the other hand, if a gas company were purchasing its gas from an independent bye-product coking company, the commission would only be called upon to decide whether the price paid for the gas under the contract was a reasonable one as compared with the cost of gas to the company by any of the well-recognized processes of gas manufacture. If it could be shown that the gas company was buying gas at less than it would cost to make it by either the water gas, coal gas, or mixed process, the commission could scarcely deem the contract an unreasonable one. But when the bye-product coke plant is an integral part of the gas company's equipment, and its finances are not separated from those connected with the distributing system, it becomes a more difficult thing to determine what should be allowed as the proper cost for gas in the holder, on which the rates are to be based. It is clear that up to the point of putting gas in the holder, the return on the investment should be much higher than the return allowed by rate-making bodies on the investment in ordinary gas plants; but how much higher or by what method the manufacturing process is to be related to the rest of the business in the judgment of the regulating body, is a question which has never yet been remotely considered by any of our public service commissions.

In my judgment, the bye-product coking industry should be kept distinct from the gas business in all questions involving the public regulation of rates; and in view of the uncertainties regarding the rate of return which would be deemed reasonable by the regulating body, I do not believe that it would often be possible to interest the investor in a bye-product coke-oven as part of the equipment of a public utility. Again, local considerations made the undertaking by the Citizens Gas Company justifiable. The Company was financed locally by people who either subscribed small sums on account of public spirit or were influenced by confidence in the promoters of the Company. The success of the Company has been sufficient to enable it to finance its enlargements and extensions. But in a great many cases where the capital that is called to the service of the public utility is wavering between investment in its securities and investment in other securities in some other place, it may be questioned whether many gas companies could successfully finance bye-product coke-ovens so long as there remain so many and intricate unsettled questions connected with the public regulation of rates. In a number of instances where I have been consulted by persons interested in obtaining the advantages of bye-product coke-oven gas for gas companies, I have invariably advised a complete separation of the two industries. I believe that it is to the mutual advantage of both that the connection should be contractual rather than proprietary.

A General Conclusion.

My general conclusion, therefore, is that at the present time the most economical known method of gas manufacture is the bye-product coke-oven, and that it is so economical that it should be employed wherever conditions justify it. But, on the other hand, it is not only impossible to give it universal application to the needs of gas companies, but also it is generally unwise to have the gas company itself own and operate bye-product coke-ovens even where the location is well adapted to the establishment of a bye-product coking-plant. When a gas company considers the installation of such a plant, most careful investigation of the whole situation is required; and a complete diagnosis must usually lead to the conclusion (to use the language of the doctors) that bye-product coke-ovens are "contra-indicated."

Scottish Junior Gas Association (Western District).—Next Saturday is the date fixed for the annual general meeting of the Association, which will be held in the Corporation Lighting Department Offices, No. 20, Trongate, Glasgow. In addition to the consideration of the report and balance-sheet and the election of office bearers, there will be a lecture by Mr. W. Cranfield.

Steel Pipe in America.—Figures compiled by the American Iron and Steel Institute show that in 1913 about seven times as much steel pipe as wrought-iron pipe was made. In 1905 the amount of steel pipe was only a little more than double that of iron pipe. The quantity of the latter produced year by year, however, remains about stationary or slowly declines, while steel pipe production has rapidly increased. The use of steel in making welded pipe was not successful commercially until about the close of the eighties; but it has had a very rapid growth in the quarter of a century since it began—the output last year having been no less than 2,189,000 tons.

Home-Made Retort Cement.—Mr. B. W. Perkins, the Manager of the Hartford (Conn.) Gas Company, reports good results from the use of a retort cement composed of one part of fine ground brick, one part of fire-clay, and one-third part of asbestos fibre, mixed into a stiff putty with equal parts of silicate of soda and water. This cement hardens when exposed to the air; and economy is effected by mixing it as needed. The proportions of silicate and water can be varied to suit conditions. This putty sticks to a hot surface almost as well as to a cold one; whereas cement mixed with water will not adhere readily to a hot surface. The asbestos fibre is used more as a binder than anything else.

DETERMINING THE CANDLE POWER OF GAS.

"Periodic" v. "Holder" Method.

At the last Meeting of the New England Association of Gas Engineers, a paper on "Coal Gas Candle-Power Determinations" was read by Mr. L. J. WILLIAMS, the Chemist to Messrs. C. H. Tenney and Co., of Boston (Mass.).

In his opening remarks, Mr. Williams referred to the variation which takes place in the illuminating power of coal gas made in horizontal, inclined, or vertical retorts charged intermittently. After charging, it will increase rapidly to a maximum, and then gradually drop to a minimum just before drawing. A series of readings taken every 20 minutes over a period of five hours showed a wide range—starting with 14 candles at 7.20 a.m., rising to 16·8 candles at 9.20 a.m., dropping to 12·5 candles at 10 a.m., and rising to 19·8 candles an hour later; the average being 16·1 candles. The gas tested was made in inclined retorts; the carbonization period being 4 hrs. 50 min., and half of the retorts being charged every 2 hrs. 25 min. In the author's opinion, the ideal way of obtaining a fair and accurate average of the candle power would be to take readings at least every half hour throughout the 24 hours; but to do this would necessitate employing two or three men for no other purpose. In a company where a large laboratory is maintained, with a staff of chemists, this is possible; but in a company of average size only one chemist is employed, whose duties are to make other routine tests besides taking candle-power readings, of which usually three are taken daily.

With the average gas company Mr. Williams says the periodic method of taking candle-power readings of the coal gas is a very good one. This means taking periodic readings three times a day—one when the candle power is at its maximum, one when it is at its minimum, and one when it is at an average. A series of tests made at Springfield and Malden in 1909, covering a period of two months, determining the candle power by the method named, and by taking five-hour cycle readings twice a week, showed that the average of the two methods checked within 0·2 candle.

The periodic method with three readings daily, and checking with a cycle reading once a month, was used in the Malden, Springfield, and Fitchburg plants for two years. It was not satisfactory, because it did not furnish any information about the candle power of the coal gas made at night. So in the summer of 1911 a series of experiments were started by collecting a sample in a small holder, and then determining the candle power.

First a 6-feet meter-prover was connected to the coal-gas pipe running to the photometer, and a series of ten tests were made, allowing the holder to fill very slowly. Meanwhile a reading for candle power was taken every 15 minutes. When the prover was filled, the gas collected was run through the photometer, and several readings were taken to see if the gas stratified in the holder. The results of the tests were as follows:

Average Cycle.	Calculated.	Gas in Holder.	Average Cycle.	Calculated.	Gas in Holder.
15·6	15·3	15·0	14·9	14·9	14·4
14·7	14·7	14·7	15·6	15·6	15·5
14·5	14·6	14·3	16·3	16·3	15·9
16·2	16·3	15·7	15·8	15·8	15·2
16·0	16·0	16·0	16·2	16·2	15·9

Averages: Average cycle, 15·6; calculated, 15·6; gas in holder, 15·2.

The average candle power is the average of the cycle readings. The calculated candle power was obtained by taking the station-meter reading every 15 minutes, and determining what percentage the gas passed for each 15 minutes bore to the total quantity of gas that passed the station meter while the prover was filling; then multiplying this percentage by the candle power of the gas for that period. By doing this for each 15-minute period, the sum of the products obtained will be the calculated or theoretical candle power of the gas made during the time the prover was filling.

After the above tests had been completed, a holder 3 feet in diameter and 3 feet high was made and connected in a similar manner. Another series of tests were made in the following way: The flow of gas into the holder was regulated so that the vessel would fill up between 5 p.m. and 8 a.m. The gas that had been collected during the night was tested the first thing in the morning. Any gas remaining in the holder after the test was run out through a blow-off, and the holder was allowed to fill up during the day and tested about 5 p.m. The time required for taking the two readings and blowing the gas out of the holder was less than an hour; so the two tests would represent the gas made during 23 hours out of the 24. The regular tests were made on the coal gas by taking readings at a high, low, and medium point.

At first the candle power of the gas collected in the holder was much lower than the regular tests showed. This was probably due to the water in the holder robbing the gas of some of its illuminating constituents. After allowing the gas to stand in the holder for two weeks, the water became saturated with the gas, and no further difficulty was experienced.

A series of tests were made, using the holder and periodic methods, covering a period of two months. The average showed the gas collected in the holder during the day to be 15·4-candle power, while that collected at night was 15·2-candle power; giving the average for both of 15·3 candles. The average of the periodic readings was 15·3-candle power.

The holder method has been the standard for testing the candle power of coal gas at Malden, Springfield, and Fitchburg, for the past three years. It is checked from time to time by taking a cycle reading and comparing the average with the gas collected in the holder. About 50 of these check tests have been made in the past three years, and they have always come out very well. The greatest difference so far observed between the gas in the holder and the average of the cycle reading has been 0·3 candle, and this difference has been found only once.

VALUE OF BENZOL RECOVERY.

In view of the increased value of benzol resulting from the present war, the "Gas Record" (Chicago) for the 10th ult. contained a long article by Herr Franz Puning, on "Benzol and its Recovery from Coal Gas."

In his introductory remarks, the author points out that, according to various tests of American coals, the average benzol recovery would amount to 2 gallons per net ton. As benzol will be used chiefly as a motor fuel, the retail price can be taken as the price of gasoline, which at present has a value of 18 c. per gallon; but for the producer 15 c. will be considered. The cost of making a gallon of benzol amounts to approximately 6 c. per gallon. Consequently the profits realized in the production of benzol from a ton of coke is equal to 1·35 tons of coal by 2 gallons by 9 c. = 24 c. He goes on to say that the recovery of benzol is profitable in gas plants providing the antique requirements for candle power are done away with—the gas being sold on its calorific value. The range of coal is then practically unlimited that will produce a good quality of gas and domestic coke. From 1000 cubic feet of gas produced from an average coal, about 0·18 gallon of benzol can be recovered, showing a profit of 1·7 c., the loss in volume being inappreciable. Considering the steady demand for gasoline, the profits of a benzol plant can be taken for granted. The number of bye-product coke-ovens in the United States is to-day about 6200, with a total annual consumption of 14,800,000 net tons of coal. If the benzol in this coal were recovered, the annual production would be 29,600,000 gallons, valued at $1,400,000.

Having described the characteristics of benzol, the author deals with its uses. He states that for many years the most important use of benzol was in the production of aniline dyes—being first converted into nitro-benzol and then into aniline, the raw material used in the manufacture of artificial organic paints and dyes. All homologues of benzol are used for the same purpose; and even up to 1906 something like 75 per cent. of the total amount of benzol produced in Germany was used in the aniline dye industry. Explosive materials are fabricated from benzol and its homologues; for instance, nitro-benzol, and recently a more important explosive known as trinitrotoluol—$C_6H_2(CH_3)(NO_2)_3$. The use of benzol and its homologues for illuminating purposes has been known for a long time. Benzol and toluol, mixed or unmixed with gasoline or spirits, is burnt in mantle burners, some of which have illuminating power as high as 3000 candles, and producing a very cheap light. Benzol is used for carburetting illuminating gas. This use is of importance chiefly in the United States, where gases of a certain illuminating power are demanded.

The various uses of benzol having been enumerated, the author describes in detail the method of recovering and purifying it, and then comes to the question of the profits resulting from the employment of the plant. He gives the following calculation as an annual average based on 2000 net tons of dry coal per day:

Revenue.

	Gallons.
Benzol, 67 per cent.	978,000
Toluol, 16 per cent.	234,000
Xylol, 8 per cent	117,000
Solvent naphtha, 9 per cent.	131,000
	1,460,000
1,400,000 gallons at 15 c.	$219,000
Crude naphthalene, 330 net tons, at $5	1,650
Regenerated acid, 40° Baumé, 360 net tons, at $6	2,160
Total	$222,810

Expenditure.

Raw materials, as wash oil, sulphuric acid, caustic soda	$15,000
Steam for the different distillations	15,000
Electric power for water, oil pumps, agitator, and illumination	6,200
Wages of three distillers and two helpers	5,000
Overhead expenses, fire insurance, maintenance, and depreciation, assuming the cost of the complete plant to be about $300,000	30,000
Calorific loss of the gases	13,000
Total	$84,200

Profit: $138,610 = 46 per cent. on the capital.
Cost to produce 1 gallon of benzol, 5·8 c.

In his concluding remarks, the author says the future of benzol plants appears to be bright. He points out that the operation of the plant is very simple, and does not require any expert knowledge—very few chemical tests having to be performed. The manufacture of benzol products is as simple as the production of sulphate of ammonia.

THE WORKS OF THE HORNSEY GAS COMPANY.

Inspection by the London and Southern District Junior Gas Association.

Though, on looking backwards, five years is a space of time that is easily bridged by the memory, it is withal a period sufficient to lead to the anticipation that in its passage much has happened in connection with a progressive gas undertaking. Such anticipation was found to be fully warranted in the case of the Hornsey Gas-Works, when, on Saturday afternoon, after the lapse of five years, the writer, for a second time, was afforded an opportunity of going over the works, under the genial guidance of the Engineer and General Manager (Mr. J. W. Buckley). The occasion of both visits was an inspection by members of the London and Southern District Junior Gas Association; and each was unanimously voted by those present to have been eminently successful from the point of view of both pleasure and profit. The welcome which visitors receive is of the warmest; features of interest are numerous; while the cleanliness, order, and general upkeep of the works are of a standard which may be equalled, but surely cannot be surpassed. At Hornsey, one can see how really pleasant a place a gas-works may be made—aided, of course, by open surroundings and an ample site. Opportunities in this respect, as in others, are not equal. It is, however, not upon the possession of the opportunity that there is a desire to compliment those, from the Engineer downwards, who are connected with the Hornsey works, but upon having taken the greatest possible advantage of the opportunity.

Assembling in the offices, the members, led by the President (Mr. J. Hewett), were met by Mr. Buckley, who extended to them a welcome, both on his own behalf and on that of the Directors of the Company. The visitors (among whom was Mr. F. J. Bancroft, the Engineer and Manager of the Barnet Gas and Water Company) were then divided into four groups, and taken over the works, under the guidance of Mr. Buckley, assisted by Mr. Ratcliffe (Acting Superintendent), Mr. Peaty, and Mr. Owen, Junior. Mr. W. E. Roberts (the Secretary) and other officials were also of the party. A useful addition to the verbal explanations given was an excellent description of the works which Mr. Buckley had had prepared for the occasion.

A Growing Demand.

An account of the previous visit of the Association will be found in the "Journal" for March 15, 1910, when some photographs were given, to which reference will be useful as supplementing the illustrations of the plant accompanying this article. That changes are to be seen in the works is not to be wondered at, when note is taken of the growing demand for gas. The make, which in 1905 was 442½ million cubic feet, had in 1910 passed the 527 million feet mark; and by 1914 the figure had risen to 589¼ millions. This continued growth is, no doubt, due to the active policy pursued by the Company on the distribution side. How much the Company do for the consumers, as compared with what was generally regarded as sufficient in times gone by, is indicated by Mr. Buckley's statement that while recent improvements have resulted in a saving of something like 6d. per 1000 cubic feet in costs on the works, the extra attention given on the district during the past six years to the various consumers amounts to no less a sum than 10d. per 1000 feet.

The Company's area is the Borough of Hornsey—which includes Harringay, Crouch End, Muswell Hill, Fortis Green, part of Highgate, and a detached portion of the parish of Clerkenwell. To this district the gas is sent out by 30 and 18 inch mains; while high-pressure installations, situated at the works and Muswell Hill, supply the principal shopping parts. The Muswell Hill plant consists of two Keith compressors, coupled direct to gas-engines, capable of compressing 2000 cubic feet per hour each; while at the works there are two Keith gas-engine driven compressors to compress 500 feet per hour each, and one of 1000 feet capacity. The two show-rooms on the district are situated respectively at Crouch End and Muswell Hill; the former being combined with the rental and collectors' offices. Both show-rooms are modern, and contain a large and varied stock of gas apparatus. The Company have also in their service two lady interviewers and demonstrators, who advise consumers as to the best methods of using gas in the home.

All this should in due course lead to that still further augmented demand for which the Company are so well prepared both in the matter of existing plant and room for extensions. Not only in the matter of size, but also in respect of situation, is the works site favourable; for it is adjacent to the main line of the Great Northern Railway, parallel with which three coal-stores adjoining the retort-houses have been arranged. Coal is brought direct into them by three separate sidings. The floors of the stores are on a level with the yard, the rails being 27 feet above; and as tip-bottom waggons are used, this is an excellent arrangement for getting the coal from the waggons and storing it with a minimum of labour.

The Retort-Houses.

It was in the two retort-houses that one of the principal transformations was seen. At the time of the visit in 1910, hand stoking was employed; but last year both houses were adapted for machine work, and "Guest-Gibbons" charging and discharging machines in duplicate were installed. In connection with these machines, Mr. Buckley was able to show and fully explain to the visitors something quite new. This was the arrangement patented by Mr. Bancroft and his Assistant, Mr. J. B. Hansford (who is a member of the Association), for enabling retorts to be filled substantially completely with coal. Mr. Buckley remarked that as at first designed the "Guest-Gibbons" machine did not fill the retorts as completely as might be desired; and to get over this difficulty the improvement referred to had been introduced. That the invention [which was described and illustrated in the "Journal" for Jan. 5 last, p. 37] is capable of doing what is required of it, was shown by a charge which had been laid in a cold retort; and Mr. Buckley remarked that, this being so, the advantages accruing from having the retorts filled furnished good reason to suppose that the Bancroft-Hansford apparatus would, when its merits became more widely known, be seen in operation at many gas-works throughout the country. In this arrangement, there is a tray-plate which precedes the head of the charger as it enters the retort; and on this tray the coal is placed. When the desired point in the retort is reached, the tray is withdrawn, and the stationary head pushes the coal off, so filling up the retort. A 20-foot retort is filled in three or four operations.

At the time of the first visit, main interest attached to No. 2 house, which had then been newly fitted up, by Messrs. Gibbons Bros., of Dudley, with five through beds of nine retorts, on the regenerative system; these, in 1909, taking the place of direct-fired retorts. After having been at work for 1800 days, the front walls of two of these benches were removed for inspection; and evidence was found of the first-class manner in which the work had been carried out. Though for 1000 continuous days the furnace-fires were never out, the retorts were seen by the members to be still in a fair condition. In fact, for the time they have been at work the shape of the retorts is extraordinarily good; while as for the walls, it was found when the fires were let-down that not more than about 10 or 11 inches of brickwork had been burnt through. The heats employed, it should be mentioned, are on the high side. In No. 1 house there are nine through beds of nine retorts, also on the regenerative principle, all with modern fittings, hydraulic mains, retort-house governors, and tar-towers; these having been erected subsequent to the visit in 1910. The maximum daily make of the two houses is about 2 million cubic feet. Using half Yorkshire and half Durham coal, the yield of gas per ton is something over 13,000 cubic feet; the make per mouthpiece per day (twelve-hour charges) being 8000 cubic feet, or 16,000 feet per retort.

The two houses were divided at the earlier date; but with the installation of machinery alterations were made so as to provide a continuous run. There are two sets of coal breaking and elevating plant—one set at each end of No. 1 retort-house—with receiving-hoppers of 25 tons and 100 tons capacity respectively. The latter spans the central coal-store, a portion of which is now reserved for the passage of the charging machines from one house to the other. Of course, the effect of placing overhead hoppers at both the middle and end of the range of retort-benches is to minimize the distance the charging machines have to travel to secure a supply of coal. Usually coal-breakers are to be found below the level of the ground; but Mr. Buckley has been able to avoid the cost of sinking and the difficulties attendant on the supervision and repair of below-ground coal-breakers, by taking the level of the charging stage as the level of the coal-store, which allowed of the coal-breaking machinery being placed on the ground level.

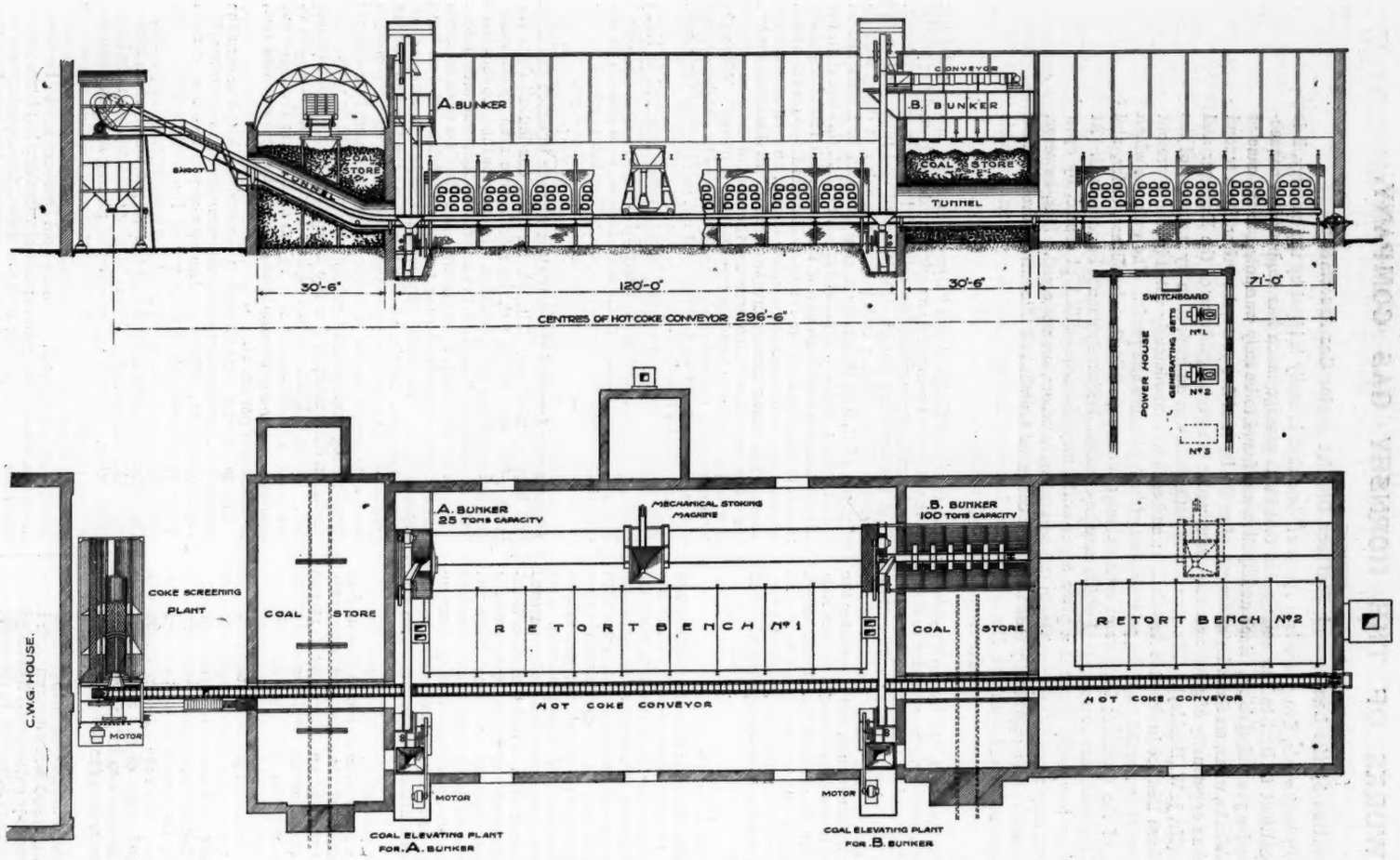
There is also another retort-house, the erection of which was practically completed six or seven years ago; but it has never been required—owing, of course, as Mr. Buckley pointed out, to the fact that in the meantime direct-firing has given place to the regenerative system, and increased the capacity of the old houses by 50 per cent. Other ground available is now utilized by the men as allotment gardens, and (in due season) for playing bowls and tennis.

Coke Handling and Water Gas.

There is an exceptionally long hot-coke conveyor—the coke being quenched by sprays as it leaves the retort-house—which runs in one continuous length along the retort-houses and by an inclined path to a rotary screen, from which the sorted coke falls into a storage bunker, in connection with which bagging shoots are provided for filling sacks or vehicles. The conveyor passes through

reinforced concrete tunnels in the coal-stores, made large enough for a man to enter and do any work that may be required. One point about the rotary coke-screen is that it is roofed-in; this having been found necessary to preserve the coke in good condition during the bad weather. The coke-screen is quite close to the water-gas house; and a very simple idea in connection with it has resulted in the saving of an annual sum which would make many a patentee envious. This idea consists in taking the coke direct from the end of the screen, by means of an inclined plane, to the bogies on the charging floor of the water-gas house, thus relieving the coke-bunker and saving labour in handling, and the work of lifting the coke from the yard level to the charging stage.

With regard to the carburetted water-gas plant, this consists of four sets, of a combined producing capacity of 2¼ million cubic feet a day. Two of the sets were among the first erected in this country; but recently the whole of the plant has been remodelled. It has all been fitted with reverse-make apparatus and valve interlocking gear; while two sets have pyrometers to scientifically control the working. The gas distributing main is interconnected with the washers and scrubbers, so that the whole of the scrubbing and condensing plant becomes available for the gas produced by all or any of the four generating sets. So far not more than two sets have been required to be at work at one time; so that there is ample scope here for meeting a further demand for gas. From the plant, the water gas passes to a small holder, which is used as a relief holder.



COAL AND COKE HANDLING PLANT AT THE HORNSEY GAS-WORKS.

Other Plant.

The exhausting plants for both coal gas and carburetted water gas are housed under one roof; but each is connected to 18-inch yard mains, and deals with the gases separately. Both are in duplicate; the coal-gas exhausters being capable of dealing with 140,000 cubic feet per hour, and those for water gas with 80,000 feet per hour. After leaving the exhauster, the coal gas passes, in the order named, through a tar-extracting washer, two purifying machines, and a "Standard" washer-scrubber. The purifiers are in two sets of four boxes of the ordinary water-lute type, fixed in line, with an 18-inch centre-valve between the two middle-boxes. One set is used for coal gas; while the other deals with the carburetted water gas.

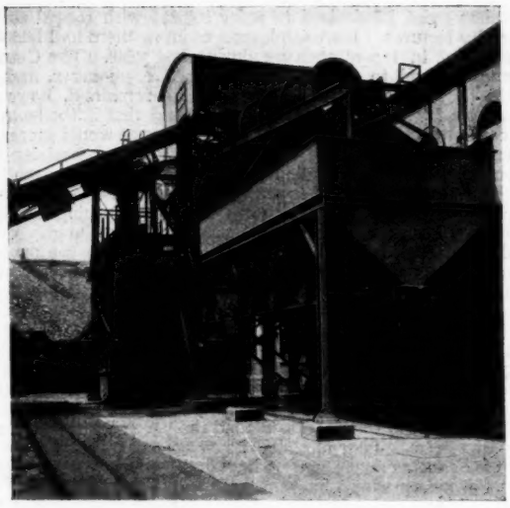
Two station meters are provided, each with a capacity of about 80,000 cubic feet per hour. Until six years ago, the whole of the gas passed through one meter; but as under these conditions it was not possible to judge accurately what either plant was doing, the second meter was installed to measure the carburetted water gas. At the outlets of the two meters both gases mix and pass forward to the holders. Of these, there are two, having a combined capacity of 1,289,000 cubic feet. In the coal-gas meter-house are two modernized station-governors, through which the gas passes through the 30-inch and 18-inch mains to the district. There is also a "Simplex" carburettor, for the purpose of dealing with naphthalene.

Power for the retort-house machinery and coal and coke handling plant is furnished by duplicate sets of 60 KW. dynamos, coupled direct to compound vertical steam-engines.

The Laboratory—Methodical Working.

The excellent idea is followed at these works of displaying in a prominent position, readily accessible to all concerned, plans of the works and mains, the valves and manholes, and the centre-valve, with mode of working. Also, the charts from the pressure-registers, &c., are each morning removed from the instruments and placed in glass fronted cases suspended from a wall, so that they can be consulted at a glance, while at the same time being kept clean.

One of the most striking features of the works is certainly the laboratory, which would be a credit to even the biggest of gas



Coke Screen and Bunker.

undertakings, so large and well-equipped is the building. Guess work does not accord with Mr. Buckley's ideas of the fitness of things; and there are to be found here all the necessary appliances for carrying out the tests usual on a gas-works, as well as for undertaking special research work.

Drawing attention to one little test in action, Mr. Buckley remarked that some years ago they were very much troubled with naphthalene, both on the works and on the district; and eventually the apparatus shown was fitted up, for the purpose of furnishing an indication of the carrying capacity of the gas with regard to naphthalene. The apparatus consists of a glass tube, and arrangements for cooling the gas. Mr. Buckley explained that it is found possible to bring ordinary coal gas and pass it through the glass tube without any naphthalene whatever showing; and then when it is passed through the cold chamber, there may be deposits of crystals the full length of the tube. But though this deposit was in the tube, it was found that if there was a certain percentage of hydrocarbons in the gas, the incoming gas would again pick the crystals up, and carry them on to the burner attached to the apparatus. The richer the gas, the less trouble was there with naphthalene. If they had no reports of naphthalene on the district, this simple test showed when to expect them. It was possible to block-up the tube with naphthalene, and still to make the gas clear it entirely in time. Thus the two main factors were the composition of the gas and the temperatures with which it had to come in contact, owing to damp ground or other causes.

Tea and Further Information.

The inspection concluded, the party sat down to tea, in Mr. Buckley's private office, and with him in the chair. Afterwards, he gave the members further information about the works, and some useful hints.

Mr. Buckley (when the toast of "The King" had been loyally honoured) said he would like, on behalf of the Directors, and himself, to give the members a hearty welcome to the works. If the visit had proved at all interesting or instructive, all those connected with the Company would feel more than sufficiently rewarded for any little efforts they had made.

A Loss to the Company.

He felt it his duty, in the first place, to comment upon a loss which both the Company and the Association had sustained through the death of Mr. W. H. Owen, who had been Superintendent of the works for the past six years, previous to which he was with him (Mr. Buckley) at Devonport, in a similar capacity, for three or four years. Mr. Owen was of a pattern to be followed, not only by juniors, but also by many of the seniors. The work that he undertook from time to time was never too hard; and he never grumbled at being called out at inconvenient times, or at the number of hours he worked. These were qualities to be admired and copied. He was one of those men who did not work solely for the money he received. In all their long association, never did a cross word pass between them; and the loss was a personal one to him, as well as to the Company.

Increasing Capacity and Decreasing Costs.

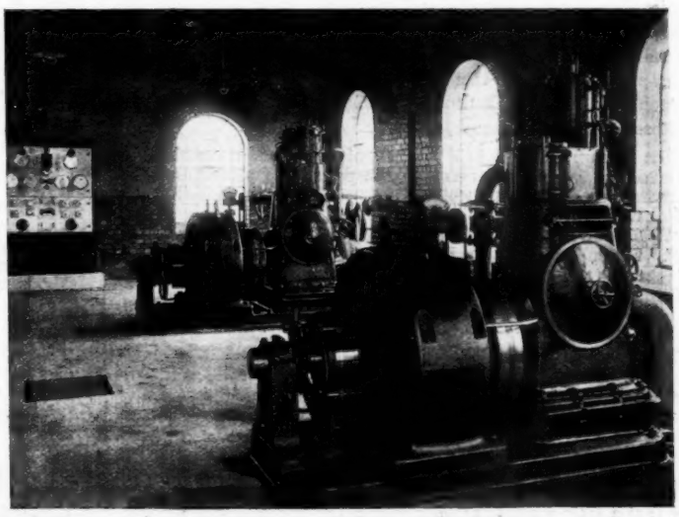
With regard to the works, the alteration of the retort-houses from the direct-fired principle to the regenerative system had accomplished everything they desired. In the first place, it had increased the capacity of these houses, within the walls, by at least 50 per cent.; and, with the cost of raw materials remaining the same, the transformation effected a saving of 4d. per 1000 cubic feet of gas in the holders—a very substantial figure. He could not say that this saving was altogether due to the reconstruction of the retort-houses; but certainly it deserved the major portion of the credit. The officials not only believed in doing "their bit" themselves, but they saw that the men did the same; and some part of the 4d. saving was, no doubt, due to the extra amount of work got out of the men. There were one or two things he had always endeavoured to keep in mind in connection with any works he was conducting. One of the first things for those in charge of works was to see that they were kept in a clean condition. Secondly, it should be seen that the works were well staffed, and that each man had his right place in the scheme. Thirdly, care should be taken that the various parts of the works were sufficient not only to meet present demands, but also for some period to come. As time went on, those who had charge of works had come to the conclusion that in many departments there had been too much capital expenditure; and it became increasingly evident that, in the face of the keen competition and other considerations, including the extra cost of labour and materials, it was the works which had a low capital expenditure that would successfully survive. Now there was nothing more affecting the capital expenditure of undertakings than gasholders. The days when storage provision should be made for 100 per cent. of the day's output were, in his opinion, past, because the load-factor was now more evenly distributed over the 24 hours than was formerly the case. Further, if they had the good fortune to be in possession of a works with a carburetted water-gas plant, this would again reduce the proportion of storage capacity necessary. It would not at Hornsey be possible to put down a suitable holder at a less cost than (say) £30,000; and he did not want to spend this money simply for the purpose of tiding them over the peak of about six weeks in mid-winter. Their storage capacity therefore remained at about 50 per cent.; and this enormous expense had been saved without inconvenience either to the Company or the consumers. The economy in manufacturing costs represented by their coal-handling plant, their stoking machinery, and their coke-handling plant (the most recent additions to the works) was somewhere about 2d. per 1000 cubic feet. But this was not the only advantage obtained. Apart from all other considerations, machinery was an advantage at times of difficulty in getting suitable labour for retort-house work. When the question of machinery was decided at Hornsey, trouble was threatening with the stokers, who were getting 6s. per shift for eight hours' work, which inquiry proved was ample for the task performed. The men demanded 6d. per shift increase, and machinery was installed, which meant the displacing of 75 per cent. of the men.

The War.

Of course, much trouble and anxiety were being caused all round by the war. Coal had gone up something like 7s. or 8s. per ton; and, in addition, there had been the difficulty of replacing men who had gone to the front. The Company had, he believed, 38 or 40 men now serving in different parts; and they had also nine or ten men who had endeavoured to enlist. It was most satisfactory, too, to note that the Association had no less than 23 members serving King and country.

A Vote of Thanks.

The President remarked that those who were present at the former visit would remember that it was quite a red-letter day in the history of the Association; and the second visit had proved no less enjoyable. A considerable amount of change had in the interval taken place in the works. The difficulties with regard to labour seemed to be endless; and in very many cases the men had only themselves to blame for the installation of machinery. The booklet which had been so kindly prepared by Mr. Buckley had helped to make everything clear to the members; and it would be carefully studied by them when they got home. The figures showed that the Company were keeping gas well to the front. Mr. Buckley had given several instances of savings which had been effected; and there was one thing, small at first sight, which seemed to him really to be specially important to juniors, as showing the advantage of always keeping one's eyes open to details. When they were in the water-gas house, Mr. Buckley had pointed out that the mere provision of a small shoot enabled the coke to fall from the end of the coke-screen direct on to the charging platform, with resultant great economy. They were all deeply grieved to hear of the death of Mr. Owen; and it would be only fitting for them to express their sympathy with the relatives, and with Mr. Buckley in the loss of so able an assistant. The works they had just inspected afforded an excellent example of the putting into practice of the precepts Mr. Buckley had laid down. Cleanliness was conspicuous in all parts of



Electric Generators.

the works; and this was an important point, because cleanliness resulted in the work being done in a more shipshape manner, and so led to economy.

Mr. S. B. Chandler, in proposing a hearty vote of thanks to the Directors of the Company for their hospitality, and to Mr. Buckley and his assistants for the trouble they had taken in showing the members round, said it was quite obvious that the three maxims laid down by Mr. Buckley were thoroughly well understood and applied. There appeared to be a great deal of character about the works; and everyone concerned was to be complimented upon the manner in which they were kept.

Mr. W. E. Brown, in seconding, also remarked upon the cleanliness of the works as being a point deserving of emphasis. It gave a good indication of the general system on which everything was carried out. Mr. Buckley's speech had been one of the most valuable features of the visit. With reference to the war, the gas industry had not been behind any other in sending men to serve their King and country; and they were pleased to know that Mr. Buckley was represented in the Navy by his son.

The vote having been carried by acclamation, Mr. Roberts and Mr. Bancroft were called upon to say a few words.

Mr. Roberts remarked that the Directors would be pleased to know the members had enjoyed the visit, and that they so much appreciated the invitation to inspect the works.

Mr. Bancroft said he had recently seen in a paper an article on waste, and it was there stated that war was a time when waste was rampant. Now, Mr. Buckley had shown them that day how waste might be avoided, not only waste of material, but waste of capital. Looking at material, they found that Mr. Buckley was now turning out about 13,000 cubic feet of gas per ton of coal, whereas six years ago the quantity was 10,000 feet. This was an increase of 30 per cent. in the output per ton of coal. With up-to-date methods, the waste of the past had been avoided. Then with a better load-factor and a water-gas plant he was able to save a large outlay that might otherwise have been incurred on gasholders and in the fitting-up of the new retort-house the walls of which were built some years ago. All this showed that waste could be avoided in the arts of peace, as well as in those of war. The works were a proof of the exercise of great prudence and foresight.

Distribution Side.

Mr. Buckley said it would be a great pleasure to him to convey the vote of thanks to the Directors. It had occurred to him that most of the remarks which had been made referred to the manufacturing side; but he was among those who believed that, whatever was done on the works, one must be well equipped on the district. There was no doubt that the various officials on the district should be well trained in the branches with which they were connected; and gas-fitters and others should also have a presentable appearance when they called at consumers' houses. The conditions found in another branch of industry with which they were faced led him to think that branch were more keenly alive to the necessity of insisting on this latter point than the gas undertakings had been in the past. A man should not be permitted to enter anybody's house in dirty overalls; and if he turned up in the morning unpresentable, he should be sent home again, and at his own expense. As already stated, they had secured a saving of about 6d. per 1000 cubic feet on the works; but while they were doing this, the extra attention they had given on the district during the past six years to the various consumers, amounted to no less a sum than 10d. per 1000 feet. This in itself was a very important item, of which the consumers were deriving the benefit. If the Company had kept on in the old groove, and not given the consumer this attention, it would have been possible to reduce the price of gas by this amount. But times were changed. The consumer demanded more attention; and it behoved the gas industry to see that he got it, and that the best possible use was made of their commodity.

MANCHESTER JUNIOR GAS ASSOCIATION.

Sixteenth Annual Meeting.

The Sixteenth Annual Meeting of the Manchester and District Junior Gas Association was held last Saturday at the Grosvenor Hotel, Manchester. Owing to the war there was not a large attendance of members—between thirty-five and forty putting in an appearance; but there were present many members of the Manchester District Institution of Gas Engineers, as well as visitors from the Yorkshire Junior Gas Association.

The President (Mr. J. M'Nicholl, of Mossley), in opening the proceedings, expressed regret at the paucity of attendance, but said he was glad to be able to inform the members that the membership of the Association was stronger than it was a year ago. A good many of their colleagues were absent owing to the war. He called upon the Hon. Secretary (Mr. James Bridge, of Stretford) to read the minutes of the previous annual meeting; and they were unanimously passed.

The President's Retrospect.

The President, in calling upon the Hon. Secretary to read the annual report of the Council, said there was very little in the report that called for special comment; but before it was formally adopted and included in the "Transactions" he would like to make one or two remarks. The first was with reference to the number of members who had joined the Colours. He considered 16 was a very good response out of 175 members—practically 10 per cent. of the whole. When they took into consideration the fact that a large number of their members were ineligible for war service, he was sure they would consider the figures satisfactory. The other point he desired to refer to was with regard to the University lectures. He was pleased to know there had been an improvement in the attendance during last year. The Council had endeavoured to cater for every class of member, and he thought they had been successful. There remained, however, ample room for improvement; and he hoped that if the lectures were continued for another year the attendance would increase. He would also like to take the opportunity of emphasizing the value of the informal discussions which took place after each lecture. They were not only very entertaining, but also very instructive. If they were not continued during the ensuing session, he was afraid that many members would be disappointed. With regard to the arrangements made by the Council for the 1914-15 session, no one regretted more than he did that the programme had had to be curtailed. It was, however, no fault of theirs—it was due to the European situation. He went on to refer to what he termed the "prize scheme" for essays or papers arising out of points of interest in machinery, &c., at any particular works visited during the session. The response to this invitation had been very disappointing indeed—only five papers had been submitted by three members. He was sorry to learn that, in the opinion of the adjudicator, none of the papers reached the "pass" mark, or were worthy of a prize. They intended, however, to carry on the prize scheme for another year; and he hoped that during the coming session the prizes would be won. He formally moved that the Council's report be adopted and entered in the "Transactions."

Annual Report and Balance-Sheet.

The Hon. Secretary then read the annual report of the Council. It was stated therein that during the year 19 new members had been admitted, being five less than last year. Ten members (four according to Rule 4) had resigned, one had been transferred to the Midland Junior Association, and one (Mr. S. H. Malone, of Bury) had died, leaving the membership of the Association at 175—a net increase on the year of seven. Sixteen members were now engaged with the Forces on the Continent and in Egypt, and others were in training in different parts of the country. Reference was made to the lectures held in conjunction with the Senate of the Victoria University of Manchester and the Manchester and District Institution of Gas Engineers. The report stated that the attendances showed a distinct improvement on the previous session, and added that there was still ample room for improvement. After acknowledging their indebtedness to the Senate, to the Manchester Senior Association, and to the Technical Press, the Council alluded to the visits paid by the members during the year to the Widnes Corporation Gas-Works and the Preston Gas Company's works, and expressed regret that the joint visit with the Yorkshire Junior Association to the Birkenhead Gas-Works had had to be postponed owing to the war. In like terms the Warrington and Darwen works were also alluded to. It was mentioned that the membership rule adopted by each of the Junior Associations was now of a more uniform character, and that greater conformity could not be reasonably expected in this respect. Appreciative reference was made to the action of the Joint Council of the Institution of Gas Engineers in extending to the President and Hon. Secretary of each Junior Association an invitation to attend the Institution meeting, and also for the invitation to the Junior Associations to contribute a paper.

The report was unanimously adopted.

The Hon. Treasurer (Mr. J. Robinson), moving the acceptance of the annual balance-sheet, said the total income amounted to £49 15s. 8d., and the expenditure to £50 18s. 2d.; leaving a balance in hand of £15 15s. 3d. He characterized the balance-sheet as a very good one.

The balance-sheet was unanimously adopted.

Election of Vice-President.

The President said that for the office of Vice-President there were originally three nominations—Mr. W. Buckley, Mr. W. H. Cummins, and Mr. C. E. Woodhead, all of Manchester. Mr. Cummins and Mr. Woodhead had withdrawn, so that there was an open field for Mr. Buckley. He had great pleasure in congratulating Mr. Buckley on his unanimous election. He was an old and enthusiastic member of the Association; and they were indebted to him for much good work. He had done a great deal of useful work, outside the sphere of the Association, on educational matters at the Manchester School of Technology. Mr. Buckley's election would prove a most popular one, and they would eventually have in him an excellent President. It gave him pleasure to move that Mr. Buckley be elected Vice-President for the ensuing session.

Mr. Buckley briefly returned thanks.

Officers for the Ensuing Year.

The report of the Scrutineers (Messrs. A. Hodgson, of Ashton-under-Lyne, and W. Hill, of Stalybridge) showed that the ballot for the four seats on the Council had resulted in the election of (in alphabetical order): Messrs. W. Fletcher, of Liverpool, W. L. Heald, of Preston, A. L. Holton and C. E. Woodhead, of Manchester. These gentlemen, together with Messrs. W. H. Cummins, F. Dean, A. Hodgson, and J. W. Nicholl, constitute the Council. Mr. Bridge was declared by the President to be returned unopposed for the post of Hon. Secretary; a similar distinction being accorded to Messrs. J. Robinson and Isaac H. Massey

(Oldham) in the respective offices of Honorary Treasurer and Honorary Auditor.

THE WORK OF THE COUNCIL.

Thanks were accorded to the retiring Council, upon the motion of Mr. W. FLETCHER, seconded by Mr. R. NEILL, of Bolton.

Mr. HEALD, apologizing for the non-presence (at that moment) of Mr. Holton, replied on behalf of the Council, and remarked that the session just closed had proved an exceptionally trying one—not, however, in regard to the lectures or the lecturers, but in regard to the visits to works. With regard to the prize offered by Mr. D. V. Hollingworth, F.C.S., of Kidsgrove, a Past-President of the Association, the Council thought it would be as well if the whole of the Junior Associations in England could have participated in it. So far as the matter stood at present [he thought he was right in the absence of Mr. Holton in saying this], two of the Junior Associations had agreed with them that the money should form the nucleus of a fund to be used to mark the best paper written by a member of any English Junior Association during a session. One Association, however, dissented from the proposal to allocate the money to this purpose. Harking back to their own Association, they could claim to have made progress in the last session, because their membership had increased. With regard to the members who had joined the Colours, the Council had decided to retain their names on the membership roll and to waive their subscriptions. Another departure which the Council had made was the allocation of two guineas to the University Lecture Fund. He thought that as the Association was fairly strong financially it was better to do this instead of the shilling fund inaugurated some time ago. As to the future, he could assure the members that the 1915-16 session would be better than ever in regard to visits to works, &c.; but he hardly thought they could improve the quality of the lectures. In had been stated in Senior circles that the members of the Junior Association were rather lax in their attendance at these high-class lectures. This was so. Without doubt there was a laxity; but when they turned the circumstances over in their minds, he felt there was real excuse for some of them. He thought he was right in saying that the average attendance was higher last session than in the previous session; but at two of the lectures the attendance was markedly low. On another occasion, however, the attendance was so high that some of the members had to sit on the steps of the Chemistry Theatre. Still, it was entirely up to them to see whether they could not do better in future—to take advantage of the lectures and of the generosity of the Senior Association.

INTRODUCTION OF THE NEW PRESIDENT.

The OUTGOING PRESIDENT said the time had now come for him to relinquish the reins of office, and in handing them over to Mr. Carter he wished him a most successful year. He (Mr. M'Nicholl) had felt it a great honour to preside over their meetings from time to time.

Mr. S. CARTER, the new President, then took the chair, and received the felicitations of his colleagues with evident pleasure.

THANKS TO THE PAST-PRESIDENT.

The PRESIDENT said his first duty was to propose a hearty vote of thanks to Mr. M'Nicholl for the able manner in which he had discharged the duties of President during the past session. His position had been beset by difficulties innumerable; but he had carried on the office with dignity. No President, in his experience, had had a more trying time; but he had come out of all difficulties with flying colours. He also desired to congratulate their retiring President on his appointment to the engineership of the Mossley Corporation gas undertaking. He would like to mention, too, that they were also gratified that a previous President of the Association—Mr. James Taylor, who held the office in 1909—had been appointed to a similar position at Weston-super-Mare. The principal disappointments of the past sessions had been dealt with by earlier speakers; but he had to confess to another. He had tried to arrange a morning visit to Messrs. Hans Renold and Co.'s chain works at Burnage. The reply, however, was that, owing to the war, the visit would have to be postponed; but the firm stated that at some future date they would be happy to receive them.

Mr. M'NICHOLL thanked the members for the cordial vote of thanks they had passed to him.

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—I wish first of all to say how deeply grateful I am to you for the honour you have done me in electing me to the position of President of this Association—a position which I accept not by any means as a right, but as a bounden duty. The years during which I have been a member of the Association have certainly been a period of progress to me personally; and there is no doubt that the debt I owe to the Manchester Juniors is a deep one—accounting as it does to a large extent for the enlargement of mind and the increase of technical knowledge of the subject of gas manufacture acquired by myself during my membership.

Possibly, handicapped as I am, with no daily experience of the conduct of the process of carbonization of coal, with the concomitant problems of efficient ammonia recovery, &c., it may be that the meetings of our Association supply more of novelty for me than for many; while, on the other hand, I am prevented, for the same reason, from contributing to the proceedings to any great extent. So I am afraid the advantage has been all on my side. You will thus appreciate my conviction that it is my duty, when called upon, to use my best endeavour to help the advancement of the Association in every possible manner.

In deciding on the subject on which to address you, I have considered that it would be presumptuous of me to do other than give some results of my own personal experience and observation, which is naturally limited to the field of carburetted water gas manufacture; and as the principal cares and anxieties with which my position has been beset have been connected more or less directly with tar, I feel constrained to make the subject of my remarks

TAR REMOVAL AND RECOVERY FROM CARBURETTED WATER GAS.

Crude carburetted water gas, after ordinary condensation, appears to be a mixture of the real gases, with a considerable quantity of a remarkably light and persistent greasy fog, which resists to a greater or less extent all ordinary efforts at its elimination—only finally effacing itself when the first purifier is reached, when all the sensible fog present is removed, to the detriment of the purifying material, which rapidly becomes inactive for the purpose for which it is required, and also throws heavy pressures in the boxes, and has a bad effect on the illuminating power. The statement that the only tar-extractor with 99·9 per cent. efficiency on carburetted water gas is the first purifier may not be original, but it is incapable of refutation.

Parallel with this persistence of tar in the gas, we have also the persistence of water in the recovered tar; and there is little doubt that these two factors constitute the main worry of the engineer who relies to any extent on carburetted water gas for his supply. It has been suggested that sudden cooling of the gas at an early stage in the handling might facilitate tar-fog removal; but this method cannot be applied at the Garston station—there being no convenient source of water supply and disposal (such as a canal) available at the works. There is therefore no personal experience on this point. In the present practice, the cooling of the gas is effected progressively; being mainly accomplished by plain pipe air-cooled condensers, augmented when necessary by a slow flow of cold water through the primary tubular condensers, but also occurring to a considerable extent in the mains. Exhaustive examinations have been made of the tars deposited in various parts of the system, including also those from the filters which follow the condensers, and "Hurricane" tar traps at the purifier inlets (to which more minute reference will be made later).

The results of these investigations are interesting in that they show the contribution from the various sources to the total tar, and the manner in which the naphthalene comes out. Appended are tabulated extracts from the results obtained.

—	Primary Tars.		Secondary Tars.			Total Tar as Sold.
	Washers and Scrubbers.	Primary Condensers with Hot Syphons.	Secondary Air Condensers with Cool Syphons	Filters.	"Hurricane."	
Estimated yield . .	200	330	330	133	7	1,000
Specific gravity . .	1·101	1·067	1·030	0·999	0·978	1·0665
	Per Cent.	Per Cent.	Per Cent.	Per Cent	Per Cent.	Per Cent.
Yield of 90 p.c. benzol	—	—	2·50	4·10	7·40	1·11
,, naphtha . .	0·55	1·60	10·07	16·68	29·09	2·33
,, creosote oil .	10·85	28·90	36·24	40·92	40·39	21·35
,, naphthalene .	*Nil*	*Nil*	6·25	7·94	7·56	4·09
,, anthracene oil	22·24	18·60	15·43	10·74	7·62	15·91
,, pitch . . .	64·87	50·71	32·70	30·76	22·29	56·70

THE EMULSION TROUBLE AND ITS CURE.

Observation of the specific gravities of the various portions led me to suspect that the "primary" tar, as deposited in a practically dry or water-free state, might be used for the purpose of dehydrating the "secondary" tars, which are apt to occur principally as emulsions, which are too light to offer much hope of themselves settling or separating to any appreciable extent. I have long been of opinion that the syphon liquor—which includes (in our case) all but the primary tar—if led in a haphazard manner into the settling tank, made the major contribution to the accumulations of emulsion with which manufacturers of carburetted water gas were troubled; and for some years experiments have been made, although with indifferent success, in disposing of this liquor in various ways.

I do not wish to bore you with details of the several methods which proved to be failures, but will come at once to the reasoning which led to the adoption of a method which promises to be eminently successful after a trial of more than two years. If we examine carefully a sample of this emulsion, it is found to consist of what might best be regarded as an atmosphere of light tar, in which float globules of water; the difference in specific gravity between the two being so little that the attraction of the globules of water for each other quite overcomes the effect of gravity. Thus the emulsion would appear to be hopelessly permanent. It was found by experiment in the laboratory that if this emulsion is slowly led to the bottom of a vessel containing heavy dry tar—*i.e.*, water free—almost complete separation at once takes place;

the reduction in specific gravity of the still dry tar proving that the atmosphere of the emulsion is dissolved into the heavier tar, and the water globules thus allowed to escape. To apply this principle on the working scale, the 2-inch delivery pipe from the syphon pumps was made to discharge into a 12-inch vertical pipe, open at both ends, standing in the settling tank, with one end above the surface of the water, and the other within 10 inches of the bottom, or below the level of the tar suction. Into this pipe all the secondary tars were therefore introduced. It was soon found that so long as there remained any stock of good tar in the tank, the emulsion in the syphon liquor was efficiently treated, and the accumulation of indifferent tar was found to be inconsiderable.

The amount of primary tar produced is generally more than enough to treat all the syphon liquor; and if any emulsion gathers in the overhead tar storage tank, it is only necessary to run it back, *via* the 12-inch duct, to effect its treatment. Most of the fine dust evolved from the plant during the run is arrested at the washers and scrubbers, and, passing along the foul water main to the settling tanks with the primary tar, settles at once to the bottom, from which it is lifted with the tar for sale, and disposed of as fast as produced. As there is a fairly regular relation between the quantity of oil used and the amount of tar made, it is not difficult to so regulate the sales as to retain a little stock; and this is checked by sampling from various depths in the settling tanks at least once every month. The tar sold averages about 18 per cent. by volume of the oil used, and contains only from 1 to 2 per cent. of water, which makes it very acceptable to the distillers.

EFFECT OF CHANGE OF OIL AND HEAT ON TAR.

With regard to the effect of change of quality of oil used on the tar produced, it must be admitted that at times some difficulties may be experienced, because light oils—as refined or kerosene, specific gravity ·820—are properly fixed at lower temperatures than solar or standard oil. The tar produced may also be much lighter than normal, some even to the point of floating on the surface of the tanks in a fairly dry condition; whereas when Texas oil is used, the tar produced is usually greater in quantity and heavier in gravity than normal, and therefore gives little or no trouble.

There was a somewhat startling illustration some nine months ago of the effect of change of heats on the quality of the tar produced. In consequence of the coming into operation of the Liverpool Gas Company's new Act of Parliament, it was required to reduce the illuminating power of the gas made at Garston from about 23 candles to 10 candles in the No. 7 "Sugg" burner, which meant a great reduction in the amount of oil to be cracked per run of make. At first, the flow of oil was merely slowed-down at the meters, and the heats were slightly reduced in anticipation that the smaller quantity of oil would be properly fixed at a lower temperature, because 15 gallons were going in during the same time that used to be taken for 32 gallons. It was soon found, however, that not only was there very little illuminating power at all in the gas, but the primary tar was not heavy enough to settle itself, much less to deal with the large quantity of light secondary tar. In the face of a threatened breakdown of the tar and water system, the heats were raised to the old standard, which resulted in an improvement in the tar, but still left much to be desired in the quality of the gas. The idea was then conceived to put in the oil at the old rate, but during only half the time, and make blue gas for the rest of the run. This, after extended trial, has proved to be a good practice, both as regards the quality of the gas and the behaviour of the tar. I am, therefore, persuaded that, given a certain grade of oil, there is only one right heat at which to crack and fix it, so as to get good all-round results. With the Anglo-American Company's gas oil, it is found that 1350° Fahr. in the superheater top, and about 1300° Fahr. in the carburettor, gives very satisfactory results.

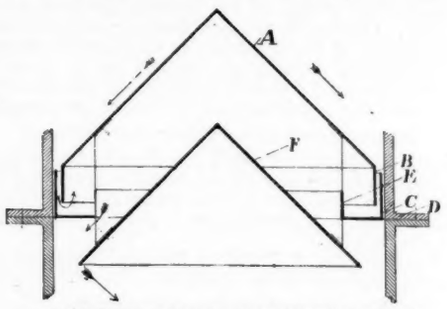
AN EXCITING EXPERIENCE.

Before leaving the subject of the recovery of tar, I would like to tell you of the exciting experiences we had in the early part of the past winter, owing in part to the temporary failure of the settling system, to which reference has just been made. A considerable quantity of emulsion had passed with the foul water into the elevated cistern, into the bottom of which it settled, mounting to the level of the supply to the scrubbers, &c. On every occasion on which it was run back to the settling tanks, it seemed to lose no time in getting overhead again; and as we were somewhat pressed just then, it was decided to postpone further effort to deal with the matter. However, the weather clerk decided differently, and for a week or two heavy gales were experienced, which had the effect of disturbing the emulsion, causing it to pass in large quantities down the supply pipe to the plant. First the dust catchers on the roof of the generator-house commenced to evolve large volumes of dense yellow smoke, and even flames, instead of the cleaned gases from the blast products, and the sludge, instead of flowing away, simply accumulated in the pipes until they were choked. Next, the small filters, designed to intercept any foreign matter in the foul water, proved to be inadequate to pass sufficient of the thick liquid to keep the seal in the washer; so we had back gas, and both explosion and fire. Moreover, what emulsion did get into the scrubbers simply baked on to the wood battens, causing heavy back-pressure to be thrown on the sets. On taking out the cages from the filters, and allowing the "liquor" to flow freely, it proved to be too thick to get away from the seal-pot overflow, and just had to escape over the generator-house floor. Several times this interesting complication developed during the night; and though we got through with only very short stoppages, I was fast coming to the conclusion that life was scarcely worth living. I would not like to confess to all the means to which we were temporarily driven to continue making nearly four millions per day, but relief was found at last by making a connection from the bottom of the overhead foul-water tank to the top of the 12-inch duct at the settling tank, and allowing the emulsion to slowly pass down into the good tar, which appears to have treated it all successfully, as no further accumulations are perceived. Need I assure you that there will be no more gathering of emulsion allowed in the overhead foul-water tank if it can be avoided; and the wind then may blow, but will fail to disturb my rest.

ELIMINATING TAR-FOG.

As mentioned in the paper which I had the pleasure to read before this Association in January, 1910, I have always been interested in methods of eliminating tar-fog from carburetted water gas, believing in the absolute necessity for some auxiliary to simple condensation. We have had experience at Garston in the use of filters, both under vacuum and under pressure. On the whole, the former appears to be the better, because by this practice the gas is not unduly dried, as it is apt to be when treated under pressure. There is, however, the great drawback, that as soon as the gas passes the exhausters, and the pressure is increased (say) from − 7 inches to + 17 inches, a fresh portion of fog appears to be developed. True, it is of light character, but still sufficient to convert the separated sulphur in the oxide to the plastic state of semi-solution, causing inactivity and back-pressure.

Some four years ago I set myself the problem of devising some means of attacking this new moiety of tar-fog, with a view to its continuous removal and disposal on the way to the purifiers, with the result that, after many experiments, I designed an apparatus and called it the "Hurricane" (patent) tar-extractor or tar-trap. The construction of the arrangement is very simple, and it can be disposed either in a bye-pass main or fixed in any vertical main where the flow of gas is downward. The apparatus consists of



Sectional Diagram of the "Hurricane" Tar-Trap.

an obstructing element A, conical in shape (with its apex against the flow of gas), from the edges of which depend a ring-plate B, some 6 inches in depth. An annular space is formed about this ring-plate, either by the wall of the main or by the fixing of a second ring C, mounted on a foundation plate D, having a hole in the centre less in diameter than the diameter of the cone. From this plate, at the edge of the hole, a third ring E rises to above the lower edge of the first depending ring, and lastly another cone F is suspended below, having a diameter some 3 inches less than that of the pipe. The plate D can be conveniently held in a joint in the main.*

The gas to be treated is bound to pass through the narrow annular space, where it is wire-drawn, and the fog particles made to agglomerate and form rain. The course of the stream is then turned up to the underside of the upper cone, which deflects it again downwards on to the top of the lower cone, which receives the deposit of tar rain, and allows it to trickle off its lower edge. Two considerations dictate the adoption of the conical shape for the obstructing elements. The first is to obtain strength, and the second is to provide a surface which will be self-cleaning continuously. If a flat level surface were opposed to the gas flow, accumulation of slurry would take place, until it had piled up somewhat, when a sudden collapse of the mass would instantly close-up the annular space, causing serious blockage. The rate of travel of the gas down the annulus should be over 60 miles per hour, while the back-pressure thrown should be from 3½ inches to 6 inches water pressure. Periodic flushing with water is sometimes desirable, in order to prevent fouling of the gas-way; and if convenient there should be a visible outlet for the tar separated, so that one can see just what is coming out, and take samples if desired.

In Liverpool we have seven extractors, each fixed in the downward leg of the U syphon valves at the inlet to the purifiers, for dealing with carburetted water gas; but we have also another extractor of adjustable type dealing with fog in coal gas, fixed on a bye-pass at the exhauster outlet. These instruments are good for removing the last traces of tar-fog, which is, indeed, all that

* An illustrated abstract of the patent here referred to appeared in the "JOURNAL" for Sept. 17, 1912, p. 762.

they are designed for, and appear to have an efficiency of about 90 per cent. whatever the nature of the gas brought to them. That is to say, if very dirty gas is treated by the "Hurricane," the outlet becomes dirty about in proportion; whereas if (as in my case), some 80 per cent. of the tar-fog remaining in the gas after simple condensation is removed by filters on the exhauster inlet, and then 90 per cent. of the remainder in the "Hurricane," we have a total efficiency in the combination equal to

$$80 + \frac{(100-80) \times 90}{100} = 98 \text{ per cent.},$$

which is as good as anything I have yet seen in the way of frictional condensation.

I have a very severe test for tar-fog, which consists of the placing of the end of a short piece of $\frac{3}{16}$-inch glass tubing, connected by rubber tube to the source of supply, against a piece of cartridge paper. The gas is passed for a period of 10 seconds, while the end of the tube is made to vibrate against the paper, on which I have never failed to get a slight stain, even on the extractor outlet, except once when the make was stopped, and only gas which had "slept" in the relief holder was passing. The slight expansion which occurs, owing to the fall of pressure between the "Hurricane" and the purifier, appears to have a beneficial effect in compensating for any slight fall in temperature, and it is found that the liquor now accumulating in the purifier bottoms is not even greasy, but consists simply of brown aqueous liquid, containing ferric sulphate, while the condition of the purifying material leaves little to be desired. When it is borne in mind that carburetted water gas contains only about 0·2 per cent. of sulphuretted hydrogen by volume, or at most one-fourth of the amount contained in coal gas, and that therefore it is necessary to treat four times the amount of gas before the oxide is charged with sulphur, the necessity for complete elimination of tar-fog will be seen to be more urgent with the former than in the case of the latter gas. The fact that we are able to successfully practise revivification *in situ* with small quantities of air (1 to 1½ per cent.), and to charge the oxide in from three to four charges to 50 per cent. sulphur, finding also a good market for the spent, is sufficient commentary on the success attending the present working.

LOWERED TEMPERATURE OF PURIFIERS—EFFECT AND CURE.

Until about two years ago we made a practice of bringing the gas into the purifiers at a temperature of about 70° Fahr., and, by keeping the purifying house windows closed, "nursed" the gas so as to carry as much of the hydrocarbon vapours as possible through to the meter outlets, where admixture with low-grade gas was made; the idea being to get a maximum enriching benefit. Some light oil was precipitated inside the holder, and gradually even tar gathered in the tank. But this was not considered a serious matter, especially as the plates of the holder were thus well preserved. Nevertheless, the appearance of the gasholder was not exactly creditable; and many were the commercial gentlemen who waited upon me with special paints and varnishes to set the matter right.

In consequence of one or two mishaps occurring in purifying houses in various parts of the country, which were generally attributed to lack of ventilation, representations were made from the Home Office, which resulted in my being instructed to remove half the window sashes from the building, thus ensuring permanent adequate ventilation. This change being made in the winter time was productive of serious results; the purifiers immediately commencing to act as condensers, and the illuminating power of the gas falling from 24 to under 20 candles, resisting all reasonable efforts to restore it to the standard. The oxide purifiers started to go off quickly; and, when opened, the material was found to contain much light hydrocarbon, which had no doubt, by its absorptive action, caused the depreciation in the candle power of the gas.

I was rather in a quandary, because previous experience had shown that whenever the filter-boxes had been allowed to cool down to 70° Fahr., they began to throw pressure; but feeling sure that no tar-trap could be expected to arrest fog which had not yet become sensible, it was perceived that the only possible cure was to reduce the temperature of the gas substantially at the condensers, even if the filters had to be bye-passed. A temperature of 60° Fahr. at the condenser outlets was, therefore, adopted, and it was soon discovered that the filters worked well and kept clear, so long as the temperature was below 70° Fahr. The purifiers also began to work in a very satisfactory manner, enabling the maintenance of the proper standard of illuminating power of 24 candles during the balance of the period for which it was required. I have come to regard 70° Fahr. as a critical temperature in the process of filtering of carburetted water gas at pressures about — 5 inches. The explanation possibly is that at this temperature some radical change occurs in the physical character of the components in the fog, or possibly the condensation of the naphthalene is most rapid just at this temperature. Whatever the cause may be, the fact remains that it is a temperature to be avoided; successful practice being possible at temperatures either above or below. It is remarkable that the tar now being yielded at the filter seal-pots is slightly heavier than that which was obtained under the old conditions; but possibly the change in the illuminating power of the gas made has had some influence.

TOLUENE RECOVERY FROM GAS.

At the present time, when toluene is so much under notice in the Technical Press, and many of us are interested in forms of plant which are proposed for large and small works (including those at Liverpool) for the recovery of the raw material for the manufacture of trinitrotoluene, it may be interesting to refer to what appear to be the prospects at the Garston works. It is proposed to erect plant capable of dealing with from 5 to 8 millions of cubic feet of mixed 50 per cent. coal gas, and carburetted water gas per diem, comprising washers, stills, &c., so that the gas oil after use can be distilled on the spot; the crude toluol fraction being separated from the other distillates, which are to be returned to the washing oil at least to the extent necessary to prevent undue deterioration of the quality of the gas. From preliminary experiments made, Dr. Colman has estimated that toluol, equal to 0·4 gallon of pure toluene, will be recoverable from each 12,000 cubic feet of mixed gas treated, equal to a total of from 13 to 21 cwt. per day. The effect of treating this gas with ordinary gas oil was found to be a serious depreciation in the illuminating power, which fell from 11·5 candles to 4·4 candles in the flat-flame, or equal to 61·75 per cent., while the calorific power also fell from 554·5 B.Th.U. to 536 B.Th.U. gross, or equal to a loss of 3·34 per cent. The modified effect of washing with gas oil containing benzol in varying proportions is shown below.

Percentage of 90 Benzol in Washing Oil.	Candle Power of Gas Unwashed.	Candle Power After Washing.	Change in Candle Power.	Change Per Cent.
Nil	11·50	4·40	− 7·10	− 61·75
3·0	12 32	9·80	− 2·52	− 20·45
4·0	11·94	10·31	− 1·59	− 13·31
5·0	11·89	11·16	− 0·63	− 5·30
6·0	11·89	12·10	+ 0·21	+ 1·80

A mixture of gas oil containing 5·66 per cent. by volume of 90 per cent. benzol was next made up, and used on the various gases, with the following results, which on both illuminating and calorific power are slight enough to be considered negligible.

Description of Gas.	Illuminating Power Unwashed	Illuminating Power after Washing.	Change in Candle Power.	Change Per Cent.	Calorific Power Unwashed.	Calorific Power after Washing.	Change in Calorific Power.	Change Per Cent.
	Candles.	Candles.			B.Th.U.	B.Th.U.		
C.W. gas.	11·76	11·93	+ 0·17	+ 1·45	521	510	− 11	− 2·11
Coal gas .	11 80	11·73	− 0·07	− 0·60	552	556	+ 4	+ 0·72
Mixed gas	12·06	11·85	− 0·21	− 1·74	546	541	− 5	− 0·91

It remains to be proved whether the benzolized gas oil will as efficiently wash out the toluene as did the oil untreated. If so, the process should be easily practicable without prejudice to the consumers of the gas.

In conclusion, I would just like to say that I hope, with the hearty co-operation of the officers and members of the Council, to carry on successfully the good work in which the Association has been, and is, engaged, and that our efforts will be appreciated and taken every advantage of by all members. Let the lackadaisical spirit which is sometimes allowed to creep in be abandoned, and earnest enthusiasm take its place. We need then have no fear but that the future will be as productive of good as has been the past; aye and more so.

THANKS TO THE PRESIDENT.

Mr. H. H. MERCER (Widnes) congratulated the President on the excellence of his address. It was said that it was given to no man to know all that there was to know on one particular subject; but he thought that on carburetted water gas their new President had endeavoured to be the exception. It was certainly an indication that he was eminently fitted for the office he had undertaken, and he (Mr. Mercer) had great pleasure in proposing a hearty vote of thanks to him.

Mr. HEALD briefly seconded the motion; and it was heartily carried.

The PRESIDENT, in returning thanks for the vote, said the difficulty of choosing a subject for a presidential address was a little more accentuated in the case of a President of a Junior Association than in the case of a man more eminent in the profession. For this reason he was cautious in his choice, and had endeavoured to make the subject both interesting and instructive. At any rate, those who had been troubled in the manner he had, with carburetted water-gas tar troubles, would, he hoped, derive some benefit from what he had said. He hoped that none of his duties of office would be less pleasurable than the delivering of his address that afternoon.

LETTERS OF REGRET, ETC.

The PRESIDENT said that telegrams and letters had been received from several gentlemen, regretting their inability to attend the proceedings.

TOLUOL.

The seventeenth item on the *agenda* consisted of the item "any other business;" and this enabled Mr. Edward Allen, M.Inst.C.E., of Liverpool, one of the three honorary members of the Association, to address the members on the question of toluol.

Mr. Allen's remarks on this question of national importance were listened to with keen interest.

The PRESIDENT, at the conclusion of Mr. Allen's remarks, thanked him for this further proof of his interest in the work of Junior Gas Associations. The raising of the subject of toluol only emphasized how apt had been his own choice of subject for the Presidential Address delivered that day. It had really been an introduction to——

Mr. ALLEN: I should have brought it in in any case. [Laughter.] I was only waiting for the opportunity.

THE SOCIAL SIDE.

The members and visitors afterwards partook of tea, and adjourned a little later for the purpose of holding the annual smoking concert and social evening.

Mr. W. HILL, in submitting the toast of "Kindred Associations," referred to the struggles of the Association in the "old days." It was good to see the friendly feeling of the present day, and also very gratifying to know that the spirit of helpfulness permeated their proceedings whenever they met. He desired to make special reference to the help accorded to them by the Manchester Senior Association, and hoped it would go forth to them how grateful the "Junior" members felt for the support they were ever willing to give them in one way and another.

Mr. EDWARD ALLEN said he was highly honoured by being asked to respond to such a very important toast—in fact, he could not imagine a more important toast than that of the "Kindred Associations." He had had a long experience with matters connected with the gas industry; but it was so gratifying to know that as one's years became more numerous the position of the gas industry improved, and to-day it was stronger in this country than ever it was. He had no hesitation in saying that this was largely owing to the interest taken by the Seniors in the Juniors, and by the Juniors in the grand industry to which they all belonged. There was, he knew, in the early days of the Junior Associations a little feeling on the part of some of their very particular seniors that it was a foolish sort of thing for the young men of the works to get together and "talk gas." In those days some of the senior members held the view that the results they obtained were matters of private information that ought not to be talked about; but seeing that no gas-works was in competition with another gas-works it followed that nothing but good could come out of free interchange of ideas, so that the whole industry might rise and rise through successful research work at any particular place. A case in point had occurred that day. The President had to his mind given them some exceedingly valuable information. It was true there were many gas-works in the country without a carburetted water-gas plant, and to such the information given in the address was of no practical use at the moment. But when they decided to take a step forward in the profession, the information might prove invaluable. He assured the members that he felt very great pleasure in being associated with the Manchester Junior Gas Association. Even when he was not able to be present, he read the reports of their meetings in the Technical Press; so that he was well aware of the very great educational work that was being carried on. He was very glad to find that when, as President of the Institution, he had the pleasure of submitting to the Council a proposal to invite the representatives of the various Junior Associations to take part in the annual proceedings, everybody agreed. There was no lack of cordiality about it at all. Everybody was pleased; and it added to the cordiality of the meeting in Liverpool to find the President and the Hon. Secretary of the Manchester Junior Association present. Although they could not have a paper from each of the Associations represented, still they had a good one from their friends of the North British Association. This year, had they been privileged to hold their annual Institution gathering at Southport under the Presidency of their friend Mr. Bond, a representative of one of the Junior Associations would again have been asked to contribute a paper. On behalf of the numerous family of kindred associations up and down the country, he very heartily thanked them for the way they had received the toast.

Mr. HEALD, in submitting the toast "Our Guests," said it was their practice to invite to the annual meeting gentlemen who had during the session assisted them in some form or other, either by visits to works or by contributing papers at their meetings. The Manchester Association was particularly indebted to the Seniors for the valuable help accorded them in the way of visiting works; for without this their endeavours to improve their knowledge of gas-works practice would be extremely hard. He was glad to see Mr. Lee present that night, representing the Yorkshire Junior Association. He asked them to pay particular attention not to include Mr. Allen as a guest, for he was not a guest—he was an honorary member of the Association.

Mr. JOHN W. LEE, the President of the Yorkshire Junior Gas Association, briefly acknowledged the toast. He hoped every effort would be made to fulfil the Birkenhead visit, as the Yorkshire members were keenly looking forward to it when it was cancelled.

Mr. W. BUCKLEY, the Junior Vice-President, next gave the toast of "The President," which was heartily accepted.

The PRESIDENT, in replying, promised to use his best efforts to further the interests of the Association, and said that he relied upon the loyal assista nce of the Council as well as of the general body of members in his efforts to do so.

The proceedings then ended.

What is considered to be the largest Diesel engine in the world has been installed at the works of Messrs. Harland and Wolff, in Belfast. The order for this engine was placed some time ago with Messrs. Sulzer Bros., of Winterthur, Switzerland. The engine is now completed, and successful tests have been made. It is of the two-cycle single-acting type, with six cylinders, and has been designed to develop 3750 B.H.P. at 142 revolutions per minute. The cylinder dimensions are about 29·5-inch bore and 39·4-inch stroke.

GAS-HEATED BAKERS' OVENS.

In the ordinary types of bakers' or pastry ovens heated by gas, a burner is placed at the mouth of the oven, fixed either permanently inside or on an elbow pipe which can be turned outside. This causes a certain amount of inconvenience. In the first place, it is quite impossible to utilize the hearth, because it is occupied by the burner; and in the second, though the hearth can be used, the pipe carrying the burner must be swung-out of the oven, where it is not only in the way but in danger of being damaged. Moreover, these elbow pipes after a time begin to leak. MM. Vuillermet and Salmon have taken out a patent for France [No. 473,572 of 1914] for an improved arrangement of oven, by means of which these inconveniences are, it is claimed, obviated. Sets of burners are placed on one side or both sides of the oven mouth, thus leaving the central hearth free, and consequently allowing the oven to be heated with wood or coal without any special alteration.

According to the invention, the oven is preferably provided with a device to assure good utilization of heat. It consists essentially of several sets of pipes, conduits, or flues of variable dimensions above and below the oven, so as to make the hot gas circulate round it before reaching the chimney.

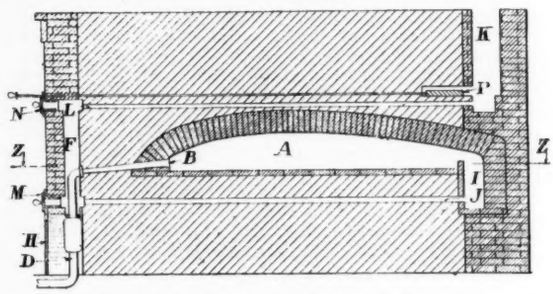


Fig. 1.—Vertical Section on Line X of Fig. 3.

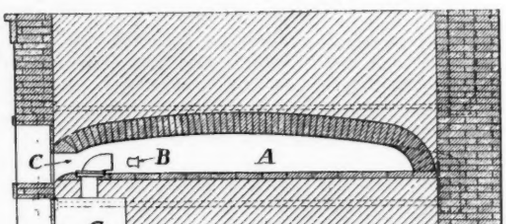


Fig. 2.—Vertical Section on Line Y of Fig. 3.

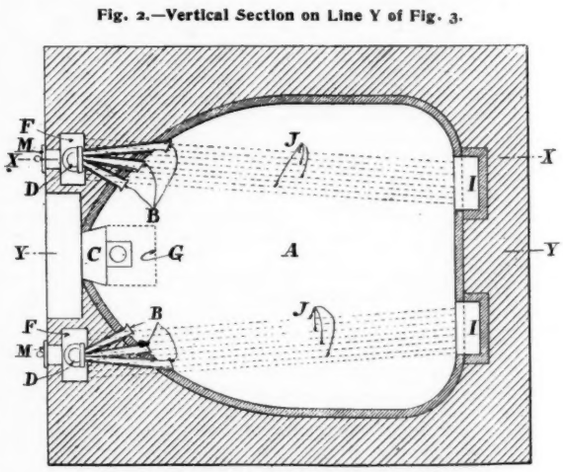


Fig. 3.—Horizontal Section on Line Z of Fig. 1.

The oven A is heated by two sets of burners B permanently fixed on each side of the mouth C, and fed by pipes D, running in vertical passages F formed in the masonry—an arrangement that has the advantage of leaving the hearth G perfectly free. Doors H in the front of the oven allow easy access to the pipes D.

The heat of the gas is completely utilized in the following manner: The gas issues at the back of the oven by chambers I, into which run horizontal pipes J, extending in the masonry under the sole of the oven as far as the conduits which communicate with the chimney K by other horizontal tubes L. Doors M N, on the front of the oven, opposite the pipes J L, allow of easy cleaning. The draught is regulated in the ordinary way by the damper P.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Value of Coke-Breeze as a Boiler-Fuel.

SIR,—The recent references in the "JOURNAL" to the value of coke-breeze as a boiler-fuel have prompted me to have compiled the working results of our using coke-breeze on the Lancashire boilers at the Granton Products Works; and the following statement gives, in tabular form, the practical results over the past eight years.

It cannot be claimed that the Scotch breeze is as good in quality as the English breeze, and, furthermore, it is more correctly defined as "dust," as we frequently riddle the breeze and extract the nuts.

The type of furnace used is referred to in the "Description of the Granton Gas-Works," pp. 135-7, where a table is also given of similar results relating to tubular boilers.

W. R. HERRING.

Palace Chambers, Westminster, April 7, 1915.

[ENCLOSURE.]

Lancashire Boiler Results.—Granton Gas-Works.

[For comparison with those published in the "JOURNAL" for March 30, p. 800.]

Year ended May, 1915.	Gallons of Water Evaporated.	Fuel Used. Breeze.	Pounds of Fuel Used Per Gallon of Water Evaporated.	Pounds of Water Evaporated per Pound of Fuel Used.
		Tons. Cwt.		
1907	6,982,000	4390 3	1·41	7·09
1908	6,342,000	4340 6	1·53	6·54
1909	6,272,000	4141 5	1·48	6·76
1910	6,993,000	4161 11	1·33	7·52
1911	6,748,000	4297 14	1·43	6·99
1912	6,734,000	3761 17	1·25	8·00
1913	6,512,000	3814 8	1·31	7·63
1914	6,824,000	3622 8*	1·19	8·40
		Average . .	1·36	7·35

* Of this quantity, 1095 tons was unscreened coke. During this period one Lancashire boiler was under repair and a Babcock and Wilcox boiler was used in place of it. Steam pressure, 100 lbs.; feed water temperature, 64° Fahr. (average).

Water Heating by Electricity.

SIR,—In inserting my letter of protest on the above matter in your issue of the 6th inst., you have gone out of your way to make matters worse rather than better by your copious editorial notes, and, as usual, you have evaded the point.

It was your unwarranted and uncalled-for insinuation with regard to my household which impelled me to write you, and which calls for a withdrawal.

I well know it is useless for an ordinary correspondent to try and score against the editor of a paper, especially in a paper so astutely carried on as your own.

May I suggest, however, that in future you go to the proper source of information before publishing your criticisms. In this case, the proper source is the official printed "Proceedings" of the Institution of Electrical Engineers.

If you had not been so eager to score a point against the electrical industry, your communication would then have been delayed until you were fully informed, also your personal insinuations would then have been entirely irrelevant.

GEO. WILKINSON.

Harrogate, April 9, 1915.

[Mr. Wilkinson is a bad controversialist. He says we "have, as usual, evaded the point" in dealing with his letter published last week; but he carefully overlooks the fact that he has evaded every point we made in the notes attached to his letter. Our impression was that those notes did cover the pertinent points of our correspondent's communication. Reading it again, its main point appears to us now, as it did last week, to be the one that the 12-gallon, 1 KW. per hour water-heater, fitted with a thermostat set at 180° Fahr., could, by changing the thermostat, give 60 gallons of water a day at 100° Fahr., and that the heater was found sufficient, in addition to kitchen requirements, for two or three baths per day—by (this is our own remark) a weary wait between for the persons desiring an electrically water-heated bath. Mr. Wilkinson also asserted that he made a statement, in his remarks at the Institution of Electrical Engineers, as to the 60 gallons at 100° Fahr. We quoted three different electrical papers to show that the reporters did not mention anything about 60 gallons at 100° Fahr. Their shorthand notes ought to disclose exactly what Mr. Wilkinson did say. We have no access to the printed "Proceedings" of the Institution of E ectrical Engineers, and so must rely on the reports that appear in the weekly Electrical Press. If the accuracy of the latter reports cannot be depended upon, then there is cause for sympathy with not only Mr. Wilkinson but the electrical industry generally. Our correspondent knows little about journalistic work, and the requirements of the readers of newspapers, if he thinks the journalist can be expected to wait for the publication of official reports before making comment. We have not observed that his suggestion represents the way the electrical or any other papers conduct their business. It is a contention that is about as —— well, we will not further risk upsetting our correspondent by expressing an opinion in this regard. But heater capacity, we now gather, was not the main point of Mr. Wilkinson's previous letter. It was—mark this!—"your unwarranted and uncalled-for insinuation with regard to my household which impelled me to write, and which calls for a withdrawal." This is really humorous. It was remarked last week that our correspondent was "uncharitable and thin-skinned." The present letter does not mitigate that view. We ask other readers to consider—they will be able to do so dispassionately and broadly—the original offending passages, and say whether they really cast aspersions on the cleanliness of Mr. Wilkinson and his family. The passages were:

> He mentioned that he heats-up 12 gallons of water to 180° Fahr. on an average consumption per day of 12·8 units of electricity; and he uses the water for washing, for baths, and drinking purposes. Heavens! His household must be very sparing of water. We cannot see 12 gallons going far in our bath; and we cannot think that *many* members of Mr. Wilkinson's family enjoy a *hot* bath the same day—*plus* water for other washing purposes and drinking.

His letter last week admitted that he could only get sufficient water for "two or three" baths "per day" in addition to kitchen requirements. We fail to see anything very terrible in the quoted passages; but last week we remarked:

> We should be very sorry to cast aspersions upon Mr. Wilkinson or his family from the point of view of cleanliness. Our "aspersions" (if this is the correct term to use) were levelled at the adequacy of the 12-gallon water-heater.

Really we do not know what more Mr. Wilkinson wants than this disclaimer—if disclaimer were really necessary—of any intention to cast "aspersions" upon the cleanliness of himself and his family. There is greater cause for us asking Mr. Wilkinson to withdraw his statement that the writer of "Electricity Supply Memoranda" "*grossly*" misrepresented him. We see he has caused further circulation of this accusation to be published in two electrical papers. One paper has guarded itself by altering the word "grossly" to "greatly;" and another paper has entirely omitted the offensive words.—ED., J.G.L.]

Mr. H. Saville, the Gas Engineer to the Calico Printers' Association, Limited, writing from Leeds with reference to the letter headed "Factory Lighting" in last week's issue, intimates that he will be pleased to give our correspondent the benefit of his experience, and possibly take him to a bleach croft where the same problem had to be tackled as that mentioned by our correspondent. Possibly others interested in the same question may like to know that such an opportunity is possible by arrangement with Mr. Saville.

LEGAL INTELLIGENCE.

The Charges against Walton Gas Officials.

At the Surrey Quarter Sessions, Kingston-on-Thames, last Tuesday, application was made for a further postponement of the hearing of the charges against Thomas H. Lamb and George W. Ross of stealing and falsification of the accounts of the Walton-on-Thames and Weybridge Gas Company, in whose employ they were. As has already been reported in the "JOURNAL," a rule *nisi* was obtained in the High Court for the removal of the trial elsewhere; and it was pointed out on Tuesday that, as this rule has still to be argued, the trial could not meanwhile proceed. In these circumstances, an order was made remitting the case to the Midsummer sessions, "or such other date, at such other place, as may be ordered by the High Court."

Robbing a Gas Company.

Albert Marven (carman), Alfred Griggs (dealer), and George Chinnery (dealer) appeared before the local Magistrates on a charge of stealing within the past three months various fittings belonging to the Southend Gas Company. Marven was employed by Messrs. Marsh and Sons, who were contractors to the Gas Company; and while engaged in the removal of fittings, it was alleged, the things were taken. Inspector Clarke procured a search warrant, and going to the prisoner's house, found various articles in different rooms. Subsequently he charged the prisoner, who replied: "When I have seen a little bit of brass about, I have picked it up." Later he made a further confession to the effect that he sold the "bits of brass" he collected to Griggs and Chinnery. These two men were then summoned for receiving the goods, knowing them to have been stolen. Marven gave evidence of his transactions with the two defendants, whose defence was that the goods were bought in a negligent manner, and not as stolen property. The Bench fined Marven £3, and the two other men £5 each inclusive.

Sliding-Scale War Bonus at Bolton.—The Bolton Town Council at their last meeting decided to pay a war bonus to adult workmen receiving not more than 30s. per week. The bonus is fixed on a sliding-scale; the most generous consideration being extended to the lowest paid men. An adult receiving not more than 15s. weekly will have a bonus of 3s.; and with the rise in wages the allowance gradually falls, until at 30s. it is 6d.

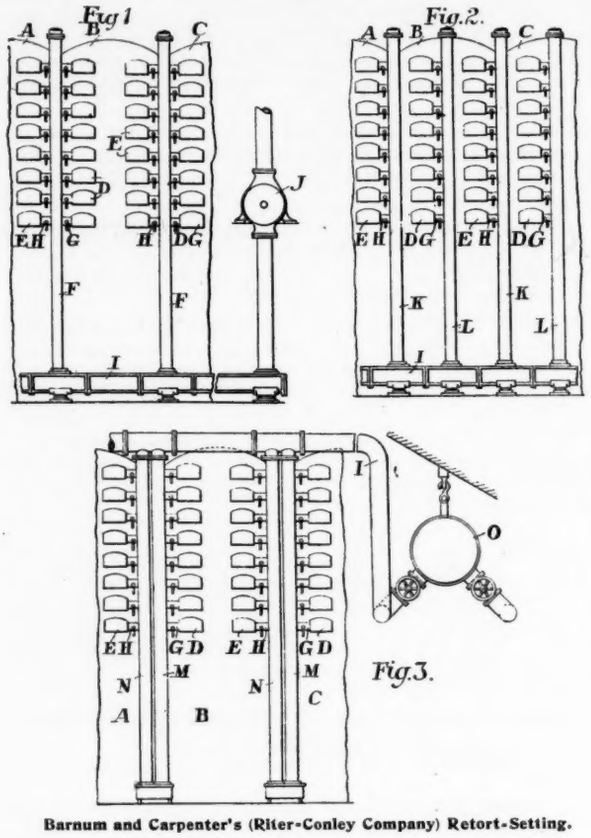
REGISTER OF PATENTS.

Withdrawing Gas from Retorts.

BARNUM, D. D., of Worcester, Mass., CARPENTER, H. A., of Sewickley, Penn., and the RITER-CONLEY MANUFACTURING COMPANY, of Pittsburg, U.S.A.

No. 5142; Feb. 27, 1914.

According to this invention, the retorts are arranged in vertical parallel rows extending back from a common face of the retort-setting, "the retorts of each row, or the retorts of pairs of adjacent rows having separate valve controlled connections leading from the mouthpiece of the retort to a vertical off-take or stand pipe leading to a main located either at the top or at the bottom of the retort-bench."



Barnum and Carpenter's (Riter-Conley Company) Retort-Setting.

In fig. 1 is illustrated gas-making apparatus consisting of a stack of retorts—three benches designated A, B, C, arranged side by side, each provided with rows D E of retorts. Each row consists of a number of superposed retorts communicating with a stand-pipe or off-take means F between the adjacent benches. The mouthpieces of the retorts in row D are provided with valved discharge pipe branches G, which communicate between a particular retort and the stand-pipe, while similar valved pipes H communicate between the rows E and the stand-pipe.

The stand-pipes between the adjacent branches are between the vertical planes passing through the longitudinal axes of the retorts in each row, and in fig. 1 all the retorts in two parallel rows communicate with off-take means common to all the retorts of these two particular rows; so that the gas and tarry distillates pass directly from the retorts through the gas off-take means into the main I, which communicates with an exhauster J.

In fig. 2, the stand-pipes alternating with the rows of retorts consist of two sets—K being between the adjacent benches, and L midway between the sides of the face portion of a particular bench.

Fig. 3 is a construction similar to fig. 1, with the difference that, instead of providing a single stand-pipe F for the rows D E of retorts, there are two stand-pipes M N; the former being common to row D, and the latter to row E. The pipes discharge into a main I at the top of the gas-benches instead of at the bottom; and this main communicates with an exhauster O instead of the one shown in fig. 1.

The constructions described, the patentees remark, "permit the carbonizing apparatus to be built to any height desired."

Atmospheric Gas-Burners.

ROSE, A., and BELLAMY, W., of Birmingham, and DOLPHIN, J., of Harborne.

No. 6233; March 12, 1914. No. 15,498; June 29, 1914.

This combined invention has reference to atmospheric gas-burners used either for heating or in combination with a mantle for lighting purposes. The invention is directed to provide means for regulating the gas near the jet, so constructed and arranged that any hissing noise (which generally becomes more acute as the gas supply is turned down) is said to be "effectually prevented."

Heretofore it has been proposed in atmospheric gas-burners to stop the hissing by employing in a contracted passage in the cylindrical body of the burner an externally operated cone-shaped valve arranged with the apex of the cone opposing the path of the gas to the jet holes which is not diverted so as to cause the streams of gas to meet diagonally. Also, for the purpose of regulating the volume and pressure of the gas passing through the jet holes without reducing or increasing the area of the holes, it has been proposed to employ in a chamber at the back of the holes an internally adjustable perforated part which could be so adjusted as to regulate the amount of gas passing through it to the holes.

The present invention is of the last-named type; but the internal perforated part (provided in the cylindrical nozzle or fitting at the back of the jet) is made like a piston, and is adapted to be operated externally so as to prevent the hissing. Any convenient means can be provided for externally operating the sliding piston valve—such, for instance, as by the valve having a lateral slot engaging with a crank pin on the end of a laterally projecting spindle mounted in a suitable bearing in the body and adapted to be turned so as to move the piston valve to open and close the gas inlet and regulate the gas supply to the jets.

Gas-Fired Furnaces or Kilns.

TOOTH, L. F., of the Commercial Gas Company, Stepney.

No. 7632; March 26, 1914. Redated Sept. 28, 1914.

This invention relates to modifications of the apparatus described in patent No. 1772, of 1913—a furnace wherein a number of combustion chambers, arranged below the floor, are formed so as to taper alternately to opposite sides and are provided with floors which slope upwardly from the narrow end. These chambers are fired by burners inserted through holes in the sides of the furnace at the narrow end of each chamber. The present invention relates to an arrangement of the burners within the combustion chambers and also to improvements in the supply of secondary air to the combustion chambers.

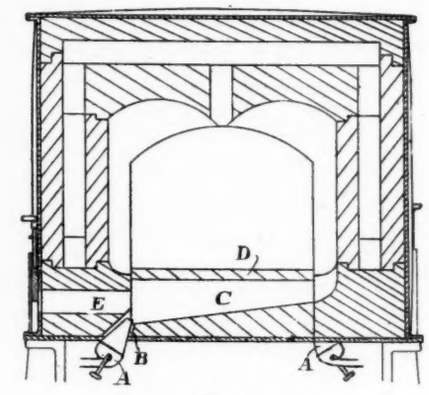


Fig. 1.

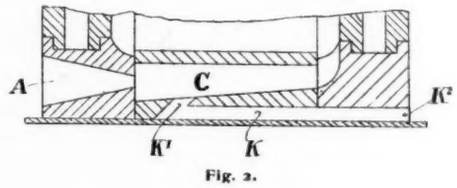


Fig. 2.

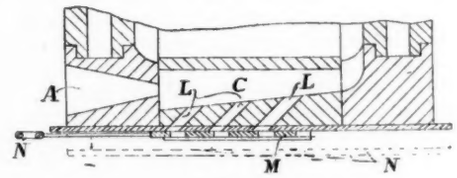


Fig. 3.

Tooth's Gas-Fired Furnaces.

Fig. 1 shows the burners A fitted into holes B in the floors of the combustion chambers C, and inclined so as to play obliquely on to the underside of the hearth D. The chambers are of the special form shown in the 1913 patent, and the burners are arranged at their lower ends. In alignment with the chambers passages E are formed through the wall of the furnace—entering their respective combustion chambers just above the burners. These passages (for the supply of secondary air) are controlled by slide valves G, or by hit-and-miss or other types of valve; and, being in alignment with the combustion chambers, they also serve as spy holes whereby the combustion can be examined.

Fig. 2 shows a modification in which the burners are arranged in openings A^1 in the wall of the furnace in alignment with the chambers C, as in the earlier patent. The secondary air is admitted through flues K in the floor of the combustion chamber—connected with the

chambers C by oblique openings K^1. The supply of secondary air is controlled by a valve at K^2.

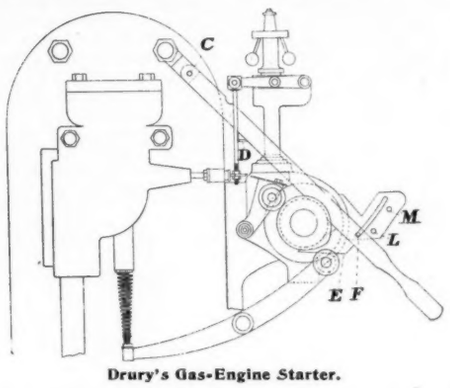
Fig. 3 shows a modification of fig. 2, in which the secondary air enters from beneath the furnace through oblique openings L, controlled by a valve M operated by a handle N. If desired, a box N^1 may be fitted that the secondary air is drawn from one or both sides of the furnace.

Means for Starting Gas-Engines.

DRURY, H. C., of Fulham, S.W.

No. 6664; March 16, 1914.

This means for starting gas-engines avoids the use of the compression stroke of the ordinary four-cycle gas-engine, by the use of a lever operating the gas and air inlet-valves, so that on pressing the lever in any arranged direction both the valves are opened.



Drury's Gas-Engine Starter.

A side elevation is given of the lever as fixed on the engine. Here C is a hole through which a stud or bolt is fitted on which the lever is pivoted. D is a small projection, fitted at a right angle to the left side of the lever, which, when pressed down, presses against a rod which opens the gas-valve. Where the arm normally operating the air-valve also operates the gas-valve as well, the projection would not be required, as the wedge E would operate both the gas and air inlet valves—opening the air inlet valve when the lever is pressed down, and closing practically simultaneously with the opening of the gas-valve by D (as described). A pin, stud, or bolt is placed in any suitable position—such as F—so as to engage in a slot in a plate or bracket fitted with two holes L and M for receiving a loose pin for holding the lever.

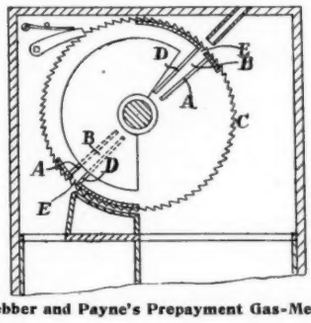
The procedure for starting a gas-engine is as follows: The exhaust valve is opened by inserting the hard-wood wedge between the exhaust cam and the countershaft. Then the piston is moved back by the fly-wheel to the full extent towards the closed end or head of the cylinder; so that the crank is at the dead-centre of the commencement of the normal ignition stroke. On removing the wedge the exhaust valve is closed; while on turning on the gas and pressing the lever, both gas and air inlet valves are opened. The piston is next moved forward by the fly-wheel, drawing in air and gas to either three-quarters or the full extent of the normal firing stroke; and the lever is moved out of working position—thus closing the gas and air inlet valves. On turning the fly-wheel back it slightly compresses the charge by the piston moving backwards on the normal firing stroke; and then the charge is fired by the magneto-striker.

Prepayment Gas-Meters.

WEBBER, W. A., and PAYNE, G. F., of West Dulwich, S.E.

No. 7330; March 23, 1914.

This invention relates to improvements in the coin-freed mechanism for gas-meters described in patent No. 8779 of 1913, "with the object of both simplifying and rendering the mechanism more reliable in action."



Webber and Payne's Prepayment Gas-Meter.

According to the present invention, the inner faces A of the front walls of the two pairs of shallow grooves B provided on the inner faces of the side walls of the drum-like structure C, forming a part of the mechanism, instead of being parallel to the inner faces D of the rear walls of the grooves diverge therefrom, to a slight extent, in the direction of the periphery of the structure C. The transversely disposed slots formed in the periphery of the drum are, however, made of the same width as before—that is to say, of a width corresponding to the thickness of the penny or other coin by which the mechanism is operated; and the rear walls of the slots E are disposed in alignment with the inner faces of the rear walls of the shallow grooves. As a result of these relative dispositions of the inner faces of the shallow grooves and the transversely disposed slots there is provided a shallow pocket in which the coin will be retained while the drum is being rotated through the greater part of the half-revolution through which it can be rotated before it is again locked in position.

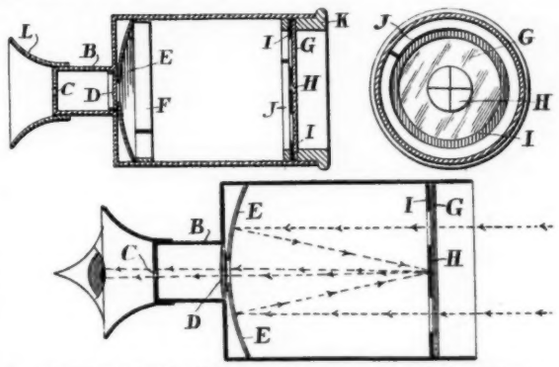
A further advantage arising from the relative dispositions of the inner faces of the front and rear walls of the shallow grooves on the inner faces of the side walls of the drum and the transverse slots in the periphery of the drum, is that the curved plate beneath the lower part of the drum need only be of short length; and the strips can be dispensed with, which in the case of the previous construction served as guides for conducting bent coins into the first of the compartments of the box placed below the mechanism, as, owing to the suppression of the greater part of the curved plate, there will be an ample passage-way for them.

Discriminating Photometer.

SOUTH METROPOLITAN GAS COMPANY and THOMAS, J. S. G., of Old Kent Road, S.E.

No. 776; Jan. 18, 1915.

This invention relates to a "portable and convenient discriminating photometer"—that is to say, "an instrument which can be used to ascertain whether there be in a place or locality any difference of light from that which is required, and which is in accordance with the adjustment of the instrument."



Thomas's (South Metropolitan Gas Company) Discriminating Photometer.

A longitudinal and cross section of the instrument are given; also a diagram illustrating how it is used.

The tubular casing shown is of opaque material—for instance, metal. At one end the casing is open; but at the other end it is closed in, and provided with a neck B (like the neck of a bottle). Closed except for the central hole C, it has within it a lens D. Within the casing, near the neck end, is an annular mirror E, of concave form, held in place by the spring ring F. At the open end of the casing is a transparent screen G—a piece of plain glass—and centrally affixed to it is a small opaque disc H, which is in line with the aperture in the annular mirror, the lens, and the hole C. Near the glass G is a diaphragm or stop I; the diaphragm and glass being retained on one side by the spring ring J, and on the other by the screw or friction ring K. L is an eyepiece fitted to the neck B. On the disc H facing the eye-hole C is a mark—for instance, a black cross on a white ground.

When the instrument is applied to the eye, as in fig. 3, if the light entering the casing through the diaphragm I and reflected from the mirror E on to the disc H is sufficiently good, the cross on the disc can be distinctly seen. The less strong, however, the light happens to be, the less distinct will the cross appear, until it becomes entirely invisible. The strength of the light entering the casing is regulated by the diaphragm or stop I, which is changed (or altered on the iris principle) until a predetermined adjustment is arrived at, so as to enable the mark on the disc to be just visible in certain circumstances. If the instrument be taken into a place where the mark can be too distinctly seen, the lighting is then in excess of what is required, and the fact is at once discernible. On the other hand, if the mark is entirely invisible then the lighting is below standard, and the fact is at once apparent.

The eye-hole C, it is remarked, should be smaller than the pupil of the eye, so that the expansion or contraction of the latter will not be likely to mislead the person making the test.

It is stated that at the next meeting of the Stafford Town Council, the Gas Committee will recommend an increase in the price of gas of 4d. per 1000 cubic feet for lighting and heating purposes, and 2d. for power, to take effect from the 1st inst.

The annual general meeting of the Sports Club of the Aldershot Gas, Water, and District Lighting Company was held last Tuesday—Mr. R. W. Edwards (the President) in the chair. The results of the past season's matches and the various averages were very satisfactory up to the outbreak of the war, which brought the season to a sudden close. The President spoke at length as to whether the club should go on the same as under ordinary conditions. He expressed his views very forcibly, and urged all members to take part in sport when possible, to assist them in keeping physically as well as morally fit. A sum of money was voted from the club funds to be expended for the benefit to those members serving with the Colours. A hearty vote of thanks to the President and Mrs. Edwards for their great interest and generous support was unanimously carried.

MISCELLANEOUS NEWS.

THE LATE MR. JOHN CARTER.

Before proceeding with the ordinary business at the monthly meeting of the Lincoln City Council last Tuesday, feeling reference was made to the loss sustained by the recent death of Mr. John Carter, the Gas Engineer and Manager.

The MAYOR (Mr. M. A. Ashley) said he wished to move a resolution of sympathy with the widow and relations of Mr. Carter, who for thirty years had ably filled the responsible position of Gas Manager. The Corporation, he thought, would be agreed that there never was a time in the whole history of the Corporation when his long experience and practical knowledge would have been of greater service than during the present crisis. He, himself, had sat upon the Gas Committee ever since he had entered the Corporation; and he had seen a good deal of Mr. Carter's work. He was always struck with his fine business intellect. [Cheers.] If he had owned the undertaking, he could not possibly have had a keener desire for its welfare and success. Apart from their business relationship with Mr. Carter, there was always a close friendship, which continued all these years, and which no differences had ever lessened or impaired. Mr. Carter had been a strenuous fighter for that which he thought to be right; but he had left behind him no resentment and no enemies. On the contrary, he had left gracious memories of a loyal and winning personality, and the memory of one who served his Council and city with an unstinted labour. Mr. Carter had a great fairness of mind, and great ability; but the position he atta ined was due to character quite as much as to ability. He was ever sympathetic to the poor, and had done much good work among this class of the city. He was sure he was voicing the feelings of every member of the Corporation when he said that they had lost a loyal, conscientious, and valuable official.

Alderman T. WALLIS (the Chairman of the Gas Committee), in seconding the resolution, remarked that he thought the Mayor had only said half of what he could have said. The services rendered to the city by Mr. Carter had been inestimable. For twenty-five years he had been closely associated with the deceased gentleman, and he could only say that their late friend had lived for his gas-works. He thought about them, and he dreamt about them. Whatever could be done to improve the works, Mr. Carter had always been the first to recommend to the Committee. Mr. Carter had also been well known in the gas profession, where he was greatly respected and looked up to. His advice had been sought after on many occasions. Many would have been glad of his services; but Mr. Carter always said "No." He would not leave the Corporation. He felt the loss of his late friend very much. They had always been friends inside the Council, as well as out of it. They had that day to thank Mr. Carter in a very large measure for the position they held as manufacturers of gas. There was little left to be done to the gas-works which could bring them any further up to date. He was sorry Mr. Carter had not lived a little longer, to be able to see the full fruits of his work. He had done everything to the concern which could possibly be done towards making it perfect. They had all lost a valuable servant; and his place would not be easily filled.

On behalf of the officials the proposal was supported by the TOWN CLERK; and the resolution was carried in silence, the members of the Council standing.

THE PRICE OF GAS IN MANCHESTER.

In the last number of the "JOURNAL" (p. 38), particulars were given of the report of the Finance Committee of the Manchester Corporation regarding the proposals of the Gas Committee to increase the price of gas temporarily by 6d. per 1000 cubic feet; it being shown that this advance, if approved by the City Council, would yield to the Gas Department an additional income of £144,000 for the twelve months ending March, 1916. The Finance Committee approved the Gas Committee's scheme; pointing out that, in consequence of the war, the department had suffered considerably owing to the increased charges for coal and oil (the latter commodity representing £10,000 more than last year), the decreased yield from residuals, the increased prices paid for stores and materials generally, the provision of about £20,000 per annum for dependants of employees on active service, and for other reasons which will readily occur to the gas engineer or manager. In addition to all this, the Gas Department hands over £50,000 a year out of the profits for the relief of the rates.

The discussion on the Gas Committee's proposal was not of a protracted character, as it was generally recognized that an increase in the price of gas was inevitable. A difference of opinion, however, existed as to what should be the extent of the increase; more than one member suggesting that 3d. per 1000 cubic feet was sufficient to meet the extra expenses of the Gas Committee. Eventually an amendment—moved by Mr. J. Russell Scott, seconded by Mr. J. Fogarty, a Labour member—that the question be referred back for further consideration, was carried by 45 votes to 41.

Alderman Kay, J.P., the Chairman of the Gas Committee, said they regretted to have to raise the price of gas; but the causes were beyond their control. The decrease in the price some time ago left the Committee with a deficit of £26,000; and since the war this had grown to £70,000, and, like a snowball, it was growing. As a result of the war, the most valuable bye-product, pitch, was unremunerative. Coal would cost £70,000 more than last year. The total deficit which the Committee had to face was £33,000. Referring to the £50,000 a year which the Gas Department hand over in relief of the rates, Alderman Kay pointed out that this year, with an income-tax of 2s. 6d. in the pound, it meant that £6250 of the £50,000 went in taxation. This, he said, was neither good business nor in the best interests of the city. The rates had received £3,170,000 from the gas undertaking, and but for the fact that contributions were made to the rates the price of gas to-day would be nearer 1s. 6d. per 1000 cubic feet than 2s.—the present figure. Mr. Scott said the estimate of the increased price showed a balance of £94,000. He argued that there were many reasons why the price of gas should not be raised—fighting the smoke nuisance, for instance. He did not think the gas consumers, many of whom were among the poorest people in the city, should bear all the burden.

BIRMINGHAM CORPORATION EMPLOYEES TO WORK ON WAR MUNITIONS.

The Birmingham City Council have prepared a scheme by which it will be possible to release over a thousand Corporation employees for service in the production of munitions and other war material.

The Gas Department, who have agreed temporarily to release 200 men, will not for some months, it is stated, experience great inconvenience, as the lessened demand for gas usually begins about May. It is the intention of the Gas Committee to use only such plant as is absolutely necessary to meet the public requirements; and a large proportion of the men will be required to work seven days instead of six days a week. There may be delays in the fitting-up of gas-services; but it is pointed out that the public, in the exceptional circumstances, must be prepared to submit to some inconvenience.

With regard to the Water Department, it is stated that extension work on mains has been reduced to a minimum, owing to the lack of development of urban and other areas. Three gangs of men are usually reserved for this class of work; but it has been found possible to manage with one gang, for dealing with burst mains, &c. The department are hopeful that there may be no grave inconvenience to the public through the curtailing of the labour; and the opinion prevails that the requirements will be met without much difficulty, providing the demands of industry are not unduly heavy.

SALFORD GAS CHARGES INCREASED.

In the Salford Town Council last Wednesday, a discussion arose over a proposal of the Gas Committee to make increases in the price of gas to meet the position created by the war and the heavy price of coal, &c. The Council were asked to sanction an increase to ordinary consumers of 6d. per 1000 cubic feet, and to reduce the quantity of gas through prepayment meters from 32·73 to 27·27 feet for 1d.

Alderman PHILLIPS (the Chairman of the Gas Committee) said it was thoroughly uncongenial to him to move the adoption of the recommendation; but it was forced upon them by the war. It was made clear to the Council in Decemder last that the finances of the Committee then showed an adverse balance, and some steps were taken towards dealing with the matter. The war, however, had taken many colliers from the pits, which were, in many cases, not now sufficiently manned to maintain their output. The consequence was that coal prices were rising, and had risen to a very considerable extent; and gas undertakings were correspondingly penalized. The opinion was strongly held (and he shared it) that the extent to which colliery proprietors had put up prices was not justified at the moment. He hoped the public would plainly express their desire that the Government should act upon the report of the Departmental Committee of the Board of Trade. In the meantime, the money obtained for residual products had only recently improved in regard to coke; and they were selling coke on contracts which were not based on present prices. They had done well in regard to tar. One of the difficulties was that pitch was consigned largely to the Continent; but this market was now closed. Three years ago residual products were bringing in £76,000 per annum; but for the year about to close they were only obtaining about £50,000, although they were getting the best possible prices. There was one alternative to increasing the price of gas, and this would be to raise the money by rate. If they took this course, the ratepayers of Salford would have to bear the whole of the burden; but by increasing the price of gas some part of the burden would fall on outside consumers who were not ratepayers.

Mr. WILLIAMSON said he would like to know whether any coal-owners had been liberated from their contracts.

Alderman PHILLIPS replied that some colliery proprietors had been able to give delivery; others had not. If the Council wished he would give the figures.

The TOWN CLERK (Mr. L. C. Evans) said that in no case had colliery proprietors been liberated from their contracts. The contracts expired in June.

Mr. BRATHERTON remarked that the position of the Gas Committee was not due to the war prices of coal, but to the poor quality of what they got. The department had this year produced 6 million cubic feet less gas, but used 338 tons more coal; while the illuminating power had decreased, and they were employing more men.

Alderman HUDDART said the price of coal had nothing to do with the position, though the returns from residuals might have a good deal to do with it. The Gas Committee would be fortunate were they able to make new contracts at a less advance than 5s. per ton. Their present recommendation was all the more serious, when it was remembered that the price of gas was advanced by 3d. only a few months ago.

Alderman PHILLIPS, replying on the debate, said they could not expect the quality of coal to be maintained under the present working conditions. Last week they had to use coal from their reserve stocks Coal always deteriorated when stored, while its use meant extra expense for labour; so that they had a smaller yield at a greater cost. Wages were increased a short time ago at a cost to the department of £3000 a year. In addition to this, £2500 a year was being paid to dependants of men who had gone to the war.

The proposed increases were passed by 33 votes to 6.

Official notice of the increase in prices was given to consumers in the Salford area within a short time of it receiving official sanction;

an announcement under the signature of the Town Clerk assuring them that it was hoped the increase would be of a temporary character. The new net rates per 1000 cubic feet to ordinary consumers (for accounts paid within a month) are:

	s.	d.
Under 250,000 cubic feet per quarter	2	10
250,000 feet and under 500,000 feet	2	8
500,000 feet ,, ,, 1,000,000 feet	2	7
1,000,000 feet ,, ,, 2,000,000 feet	2	6
2,000,000 feet ,, ,, 4,000,000 feet	2	5
4,000,000 feet ,, ,, 6,000,000 feet	2	4
6,000,000 feet and upwards	2	3

STONE GAS AND ELECTRICITY UNDERTAKING.

Proposed Purchase by the District Council.

At the last Meeting of the Stone Urban District Council, the General Purposes Committee reported that they had considered a letter received from the Directors of the Gas Company in regard to an offer by the Council to purchase their gas and electricity undertaking, and that a Sub-Committee had been appointed to negotiate for the purchase. The Sub-Committee reported that they had had a consultation with the Directors of the Company, and had made an offer of £35,000 for the undertaking, and that this would be recommended to the shareholders for acceptance.

Mr. A. P. MILLER, in moving the adoption of the Sub-Committee's report, said the question of the purchase of the Gas Company's undertaking had been under consideration from time to time for some years. In April, 1902, the Company were asked to state their terms and they quoted £37,000. But the Council could not agree to give this price. In April, 1907, the Council again asked the price of the undertaking; and the Company replied that the works had increased in value since the price was quoted in 1902, and it would then (1907) be something between £40,000 and £50,000. The matter again dropped. Last year, however, the Company promoted a Bill for an extension of their powers; and it was felt by the Council that it was impossible to let the matter go through without doing something in regard to it. They therefore took steps to put themselves into a position to deal with the Company, with the result that the latter agreed to a clause being inserted in the Bill giving the Council power to purchase the works under certain conditions. The Bill went through Parliament unopposed; and the Council prepared to negotiate for the purchase. They appointed Mr. Isaac Carr, M.Inst C.E., as valuer, and when his report came in it was felt that it was one that was made as between a willing seller and a willing buyer. The Council then approached the Company as to terms, and in the first instance offered £30,000, which the Company refused, and asked £36,000. A deputation from the Council thereupon waited upon the Directors to discuss the matter, and it resulted in an offer of £35,000 for the concern. He did not propose to give the Council a lot of figures, as this was not the time to do so. The Directors had to meet their shareholders, and it would not be politic of him to embarrass them in any way. With regard to the expert's valuation, it would perhaps be well to point out that he had said "that, with careful administration and management efficiently continued as at present, the undertaking will gradually improve its position." There were probabilities in regard to the undertaking when it was in the hands of the Council which would appeal to the public. He quoted figures to show that other councils had given prices varying from £1090 to £2062 per million cubic feet of gas, and said that Stone's figure would work out at £1094. Some of the council thought it too high; but if they wanted to gain anything they must risk something. The Council's valuer had gone into the matter very keenly, and had given them a long report. It was not absolutely and entirely favourable; so that the Council did not enter into the affair thinking they were going to get perfect works. They knew they would have to spend money; but they also knew that for what they spent they would get a return.

Mr. G. B. HADDON, in seconding the motion, said he must congratulate Mr. Miller upon his statement respecting the negotiations with the Company. He should like to say that the Directors met the Council as public-spirited men; and the result was that they arrived at a very fair and reasonable price for the undertaking—one which would pay the shareholders and ratepayers alike.

Approval of the purchase having been expressed by other members of the Council, the report was unanimously adopted.

Municipal Trading.—At the annual conference of the National Chamber of Trade, which was held in Nottingham last week, the following motion by Mr. F. Pickering (Bradford) was carried: "That the Chamber views with alarm the constant growth of municipal trading, and protests most strongly against any extension, except in the case of such monopolies as require the use of streets and roads for wayleaves—for example, the supply of electricity in bulk, or gas and water—especially as in most cases the extension would seriously prejudice local traders without any advantage to the public, and it calls upon the Government to institute a departmental inquiry into the whole question."

Loan Question at Teignmouth.—At a meeting of the Teignmouth Urban District Council last Tuesday, Mr. French moved that loans be obtained in respect of new mains and services and the purchase of meters, cookers, heaters, &c. He said that he could not see why present consumers should be called upon to pay for what would be used by the public for the next ten years. The Clerk intimated that, according to the last circular of the Local Government Board, they would not be prepared to entertain applications for fresh loans at present. Mr. Turpin moved as an amendment that, in the circumstances, the consideration of the question should be adjourned until the conclusion of the war. After much discussion, both the motion and amendment were withdrawn.

30-40 Series.

THE MAIN SPRING.

AFTER Winter departs Cookers alone, of various gas appliances, are in constant daily use in the ordinary household.

Upon the Gas Cookers that you provide for your consumers, therefore, depends the maintenance of your output.

Satisfaction-giving Cookers—"Main" Cookers—form the Main Spring, the force that maintains your sales in the Summer.

Make arrangements to provide your consumers with "Main" Cookers now, and before Autumn comes you will have reaped the benefit.

R. & A. MAIN, LIMITED.

WORKS: Gothic Works, EDMONTON, N. Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W.; 136, Renfield Street, GLASGOW; 56, Broad Street, BIRMINGHAM; 83, Old Market Street, BRISTOL; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

SHADING THE STOCKPORT PUBLIC LAMPS.

The system which has been adopted for shading the public lamps in Stockport at the bottom gave rise to some criticism at the monthly meeting of the Town Council last Wednesday.

Mr. Foley, who introduced the subject, said he thought some change should be made in the lighting of the public lamps. They were darkened by request of the military authorities, but it was done in such a way as to throw the light on the buildings. He thought they should be so arranged as to throw the light only on the footpath. He had heard that a lamplighter had remarked that the lamps were darkened in such a way as to suggest that submarines were expected. Mr. Ferns characterized the method of darkening the lamps of the borough as absolutely dangerous. He said that he had made observations in various places—London, Manchester, and elsewhere—and they all adopted quite the reverse system to that which had been employed in Stockport. If Stockport was right, then the rest of England was wrong. By darkening the lamps at the bottom, it was almost impossible for people to see when they were stepping on to or off the pavement; but by having them darkened at the top foot passengers would be able to walk in safety. Alderman Brewster thought that as there had been no complaints from the military authorities the Stockport system of lighting must have their approval. Mr. Winter (the Chairman of the Gas Committee) said the system of darkening the lamps at the bottom had been adopted after careful consideration. By this means there was no reflection on the pavement, and the authorities were anxious to avoid this. If the tops of the lamps were darkened, as in Manchester, there would be a light on the pavement. He thought the Stockport system was the best.

A motion was submitted to the effect that the General Purposes Committee should be asked to review the whole lighting of the town; and Mr. Ferns having expressed his satisfaction with this, the motion was carried.

COAL-TAR DYESTUFF INDUSTRY IN AMERICA.

The subject of the coal-tar dyestuff industry in America has lately been dealt with by the Department of Commerce of the United States in a report which has been presented to the Senate, and from which the following are extracts.

Numerous American industries are closely dependent upon the use of dyestuffs. Those derived from coal-tar products have displaced nearly all rivals; combining qualities of fastness, ease of application, brilliancy, variety of shades, &c., utterly unknown to the former generation of dyers. The American consumption of artificial dyestuffs has attained an annual value of $15,000,000, and grows steadily. It is supplied partly by a domestic production valued at about $3,000,000. This apparent domestic production is based chiefly upon the use of foreign materials—half-made or nearly completed colour compounds; but a small portion of it is made from American crude coal-tar compounds. The great bulk of the artificial dyestuffs come from Europe. The average imports are: From Germany, $7,850,000; Switzerland, $910,000; Great Britain and others, $370,000—total, $9,130,000.

Since Aug. 1, 1914, in consequence of the outbreak of hostilities in Europe, this foreign supply has been interrupted and constantly threatened with nearly complete cessation. Some important dyes are totally unobtainable; prices have mounted from 25 to 50 per cent. on such dyestuffs as can be delivered. The imports may cease any day through inability to make shipments on account of maritime dangers, or, what is more probable, through the military necessity of commandeering the available supply of the chief coal-tar crude material, benzol, for use as a motor fuel, or diverting the limited supply of nitric acid—the chief chemical used in colour manufacture—to the manufacture of explosives.

The four American establishments making artificial dyestuffs have done their best to meet the emergency by enlarging the ordinary output. They have been crippled by the difficulties or impossibility of securing half-manufactured materials from abroad or crude materials at home. Some large consumers have erected emergency plants, and make the colours they absolutely need, but at considerable cost.

In all this annoyance, loss, and uncertainty, why do we not have an American coal-tar chemical industry, capable of meeting the nation's demands, self-contained, and independent of foreign control, utilizing our native raw material?

In the United States the supply of coal tar is amply sufficient to provide in abundance all the crudes required for the manufacture of the dyestuffs consumed in America. The amount of valuable bye-products not yet recovered in our present coking plants amounts to $75,000,000 annually. With adequate provision to save all the benzol and tar liberated in American coke-ovens, enough of the ten crudes could be secured to more than cover the world's consumption in making artificial dyestuffs. If a commercial demand is present, American tar-works can quickly provide all the crudes needed, practically as cheaply as in Europe.

The four establishments devoted to the production of dyes supply nearly a hundred different colours, largely, however, as already stated, by "assembling" nearly finished products of foreign origin. These American firms are bold and enterprising, commanding about $3,000,000 capital, and are evidently doing the best they can under existing conditions to build up a national industry. Investigation shows that their advance, beyond certain limits, in the manufacture of either intermediate or finished dyes is persistently checked and prevented by the united action of German producers in underselling. The entire German colour industry is so completely organized and accustomed to act as a unit in furthering the general interests, both at home and abroad, that little success in facing their determined opposition has heretofore been obtained.

The present crisis has evoked very deep interest on the part of all

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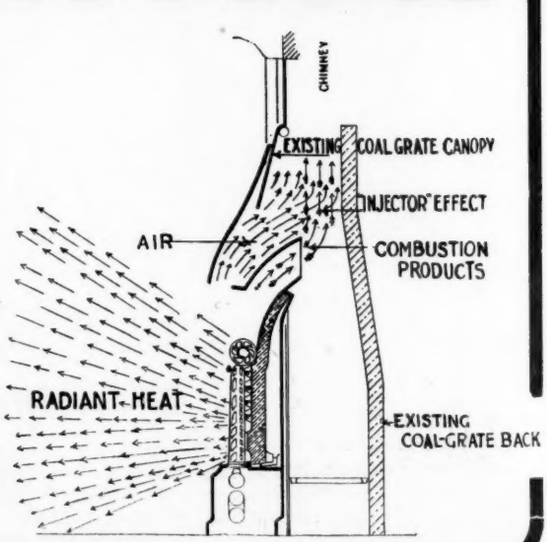
THIS IS ONLY ACHIEVED BY
WRIGHT'S
PATENT
'INJECTOR-VENTILATING'
GAS FIRES



concerned—tar distillers, chemical manufacturers, manufacturers of dyestuffs, the many users of them, and American economists in general—as to how the problem can be settled. There is no question but that our coke interests are ready to multiply their recovery plants for the production of benzol and tar, if a permanent market is assured. There is no question of the readiness of tar distillers to enlarge their plants for the production of an ample supply of the needed crudes, if a continued demand is certain. American chemical works and American manufacturers of dyestuffs are ready to embark capital and experience in building-up a distinctly American coal-tar chemical industry, using entirely American crudes and intermediates, provided there is adequate legislative prohibition against both "dumping" or unfair restraint of American trade by the arbitrary action of foreign monopoly permitted by foreign law and not as yet forbidden by our own. Foreign makers assert their ability to at once make more than 90 per cent. of the dyes consumed in the United States which are now patent free, and state that the remaining tenth will soon be freed from patent restriction.

There seems to be a consensus of opinion that any rapid development and evolution of the dyestuff branch on a scale commensurate with the nation's needs, present and prospective, can be assured only on the basis of an effective law preventing that action towards the control of our markets by a foreign monopoly which is now prohibited to a domestic monopoly. Some of the largest manufacturers have personally informed the department that what is needed is not a tariff change, but laws that would place a foreign monopoly on the same basis as an American one.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

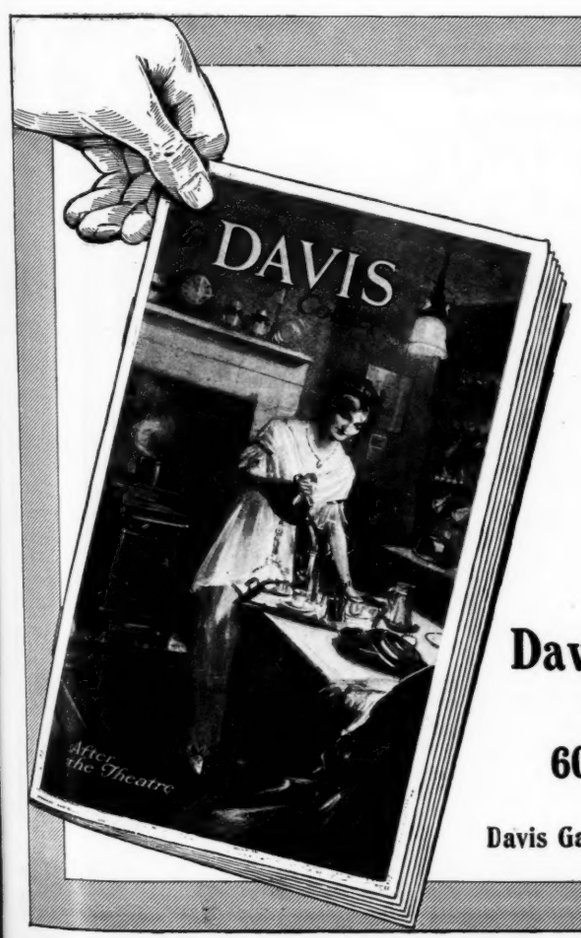
Mr. Alexander Masterton, the Engineer and Manager to the Edinburgh and Leith Gas Commissioners, is issuing invitations to a series of cookery demonstrations and lectures which the Commissioners have arranged for next week in the Free Gardeners' Institute, in conjunction with an exhibition of gas appliances. This will be opened on Tuesday afternoon, and the demonstrations will be given twice daily, by Miss B. S. Carlow, till the 16th inst.

It was mentioned in last week's "Notes" that the Directors of the Cupar Gas Company had decided to erect vertical retorts in place of the existing horizontal ones. The proposed improvements in the carbonizing plant were submitted to the shareholders at a special meeting held on Thursday, under the presidency of Hon. Sheriff Thomson. He said the matter had received the very anxious consideration of the Directors, who had decided to instal vertical retorts on the Woodall-Duckham system, at a cost of £6000. They were satisfied that these would effect a considerable saving in labour, and consequently of wages; while they would produce a greater quantity of gas, tar, and ammonia per ton of coal than under the old system, and the quality of coke would be superior. It was decided to increase the capital of the Company by the issue of 750 preference shares (5 per cent.) of £8 each, to rank *pari passu* with those now in existence, to meet the expenditure on the new plant.

The consumption of gas by the military authorities in occupation of the West Poorhouse has been the subject of a dispute between the Dundee Parish Council and the Gas Commissioners. At a meeting of the Poorhouse Committee the Clerk submitted an account amounting to £46 9s. 7d., being in excess of the sum of £10 per month agreed to be paid to the Commissioners by the Parish Council for all gas consumed for lighting purposes, with a request that the amount should be paid by the Council and collected from the military authorities. The Committee agreed to refuse payment. At a subsequent meeting another letter from the Gas Commissioners was read, intimating that from and after the 28th ult. the Parish Council would be charged for all gas passing through the meters at the Western Barracks. The Committee decided, in view of the agreement come to with the Gas Commissioners when the military took over the West Poorhouse, "that during the occupancy by the military authorities the inclusive charge for gas used would be at the rate of £10 per month," to adhere to this agreement; and the Clerk was instructed to intimate this to the Gas Commissioners. The decision has been confirmed by the Parish Council.

A conference was held in Edinburgh on Monday in regard to the supply of water to voluntary schools; the chief corporations in Scotland being represented. The Roman Catholics in Dundee claimed that instead of being charged for water as trade subjects their schools should be supplied on the domestic rate. If the schools were so supplied, they would be able to claim exemption from water-rates under the Education Act, which provides that no assessments are chargeable against voluntary schools except to the extent of any profit derived from the schools. The Town Clerk (Mr. Perrie) explained the position, and pointed out that the principal case cited by Sir James Urquhart on behalf of his clients was not altogether comparable with the Dundee case. The Judge in the Queen's Bench Division held that the school in question was a domestic subject; but further inquiry brought to light the important fact that it was a domicile for a large number of children—the children and teachers being resident on the premises. On the question of free water supply, the Clerk drew attention to the interpretation of clauses in the Water-Works Clauses Act, where it was clearly shown that the water-rate is simply a payment or reward for a commodity, and not a rate in the same sense as the poor-rate or the police-rate. As the result of the conference, Mr. Perrie is to recommend the Water Commissioners to sue for payment of arrears for the current year if they are not paid; to refuse the application for a supply of water for domestic purposes; and to terminate the present agreement, and offer the schools a supply by meter.

The Dunfermline District Committee have decided to let the contract for the construction of their new reservoir at Glendevon to Messrs. P. & W. Anderson, of Glasgow. The price for the work, which includes the formation of a road of access and the erection of the necessary fencing, is £97,000. It is computed that when completed the



The Davis Advertising Policy has been conceived in the true interests of GAS.

One manifestation of this is the newly issued **Davis Summer Booklet,** which enterprising Managers are now distributing amongst their Consumers. Another is the

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of Gas Appliances and Gas Furnishing,

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reservoir will have a capacity of 950 million gallons. In the meantime, only part of the Devon waters are to be impounded; but as the need arises through the development of the district the whole of the available supply may be used. The Admiralty are partners with the District Committee in the scheme, to the extent of one-third, and as in the case of the Glenquey supply, in which they are also partners with the District Committee to a like extent, they will receive one-third of the supply. This is solely for their works and for any fleet which may be anchored in the waters of the Forth. The construction of the reservoir will be hastened, as the Admiralty are applying for more water. It is estimated that the total cost of the Glendevon scheme, including the purchase of land and the laying of the main pipe to Glenquey, will be about £150,000.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *April* 12.

Since the last report there has been an improvement in the value of pitch, and sellers would not to-day be inclined to accept below 25s. per ton. The freight position is considerably easier. Creosote is firm at 4 7/16d. to 4 1/2d. per gallon net, in bulk, *ex* makers' works. Solvent naphtha and motor benzol continue in good demand.

Sulphate of ammonia is in good request for home use, for which the price is well maintained; the value for 25 per cent. being £13 10s. per ton, net and naked at makers' works.

Tar Products in the Provinces.

April 12.

The markets for tar products remain fairly steady, though new business has been rather quiet during the past week. Benzol remains steady, though there is not a large amount of new business. Heavy naphtha is firm, and the inquiry is good for both prompt and forward delivery. There is a good demand for solvent naphtha. Creosote is very quiet. Business has practically stopped in crude carbolic, pending the decision of the War Office as regards the crystal carbolic.

The average values of gas-works products during the past week were: Gas-works coal tar, 21s. to 25s. Pitch, East Coast, 17s. to 17s. 6d.; West Coast, 18s. to 19s., Manchester; 19s. to 19s. 6d., Liverpool; 20s. 6d. to 21s. Clyde. Benzol, 90 per cent., naked, North, 9 1/2d. to 10 1/2d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 2d. to 2s. 4d. Crude naphtha, in bulk, North, 5 1/2d. to 5 3/4d. Solvent naphtha, naked, North, 1s. 5d. to 1s. 6d. Heavy naphtha, naked, North, 11d. to 1s. Creosote, in bulk, North, 3d. to 3 1/8d. Heavy oils, in bulk, 3 3/8d. to 4d. Carbolic acid, casks included, 60 per cent., East and West Coasts, 3s. 4d. to 3s. 5d. Naphthalene, £8 to £16; salts, 65s. to 75s., bags included. Anthracene, "A" quality, 2d. per unit; "B" quality nominally 3/4d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *April* 10.

During the past week the tone of the market has been quiet, but values have been maintained at their level before the holidays, excepting in the case of a few small transactions. On the one hand, buyers have shown little keenness to make further contracts, while, on the other hand, there has not been any pressure on the part of producers generally to effect sales. The quotations to-day are still £13 7s. 6d. per ton f.o.b. Hull, £13 8s. 9d. per ton f.o.b. Liverpool, and £13 17s. 6d. per ton f.o.b. Leith. In the forward position the market has been idle. Makers have continued to ask about £13 5s. at the ports for delivery over the second half of the year, but no business has transpired.

Nitrate of Soda.

This article is again dearer, and holders now require 12s. per cwt. for ordinary, and 12s. 3d. for refined quality, on spot.

Sulphate of Ammonia.

From another source it is stated that the market for this article has been very quiet owing to the restrictions in shipment, and on the whole prices are down to the extent of 2s. 6d. to 3s. 9d. per ton. Outside London, makes are quoted at £12 17s. 6d.; Hull, £13 7s. 6d.; Liverpool, £13 8s. 9d. to £13 10s.; Leith, £13 15s. to £13 17s. 6d.; Middlesbrough, £13 8s. 9d. to £13 10s.

COAL TRADE REPORT.

Northern Coal Trade.

The coal trade is generally firm, and producers do not appear to have much coal free for sale for the rest of this month. There is not much business doing at present in steam coal, though some contracts for Norway are in course of negotiation. Best Northumbrian steams are about 30s. per ton f.o.b.; second-class steams are near 27s. per ton; and steam smalls from 15s. to 16s. per ton f.o.b. In the gas coal trade, the demand is strong, and producers have some heavy deliveries to make. With tonnage plentiful, the output is quickly taken up, and it may be said to leave little coal free for sale for early delivery. For forward delivery, there seems to be more reluctance to deal. Best Durham gas coals are now quoted at 25s. per ton f.o.b.; second-class qualities are near 23s. per ton; and "Wear Specials" are somewhere about 25s. per ton. The freight on gas coals is now down to 7s. per ton, Tyne to London. As much of the gas coal is being delivered on long contracts, it is evident that the high prices named are paid chiefly for occasional cargoes, and for quantities that are needed urgently for export. Coke is very firm. Gas coke for export is rather higher—from 15s. 6d. to 16s. 6d. per ton f.o.b. in the Tyne. At some of the inland centres of production, gas coke is also dearer—the price at Darlington being raised to 15s. for ordinary gas coke at the works.

THE Richmond GAS STOVE & METER Co LTD

The Geysers that are making Hiring Out Profitable

"Tay," with Auto Valve and wing-out Burner.

1. Richmond's "open" and "closed" types of geysers are both constructed to give special facilities for cleaning—not partly cleaned with portions inaccessible, but every square inch of gas-way and waterway is open for attention.
2. Various models are supplied to suit every requirement. Interlocking taps, swing-out burners, automatic valves—all simple and effective, with nothing to get out of order.
3. If a Richmond geyser is returned from hire, any new parts can be readily fitted, as all are removable by hand, and are standardized and interchangeable.

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General Offices and Works: **Academy Street, Warrington.**

Progressiveness of the Gas Industry.

The article on "Technical Progress" in the "Ironmonger" last Saturday is devoted to the subject of the gas industry as affected by the war. In his opening remarks, the writer says: "Although the discovery of gaslight in some particular and *quasi*-technical sense is claimed for a number of men of different nationalities, so that statues of several alleged 'inventors' of gas lighting have been erected in various countries of Europe, it is indisputable that the public service of gas supply, as distinct from private installations of gas-manufacturing plant, originated in England. The Gas Light and Coke Company is the same undertaking that was created by a remarkable effort of imaginative enterprise just over a hundred years ago, when the argument as to the domination of Europe was, as now, in full swing. We talk of 'Business as Usual' during this crisis in the world's history. Our forefathers of the Napoleonic era went considerably better in founding, amid all their perturbations and trials, an industry of an entirely unprecedented nature, which was not merely frowned upon by the learned and the great, but was held in considerable suspicion by the people, and bitterly lampooned by the popular caricaturists of the day. Yet, notwithstanding all the difficulties placed in its way by ignorance and prejudice in high places, and all the more troublesome effects of its infantile weaknesses and ailments, the gas industry made its way in the world. Successful at home, in due course it was planted on the Continent, where it also flourished."

Cost of the Neath Gas Strike.—It has been reported to the Town Council that the expense involved in the recent strike at Neath amounted to £155. Alderman Morgan remarked that the strike was forced upon the Council; for had the application of the men been granted, the cost would have been £500 per annum. Mr. Jones was agreeably surprised that the expense was so little, but did not agree with the suggestion that the strike could not have been avoided.

Rosario Water-Works.—As the result of the past year's working, the Company had available (after providing for the interim dividends, and including £11,245 brought forward) a sum of £34,928, which it was determined to appropriate in paying balance dividends of 3 per cent. on the preference shares and 5 per cent. on the ordinary shares (both less income-tax), and in placing £2000 to the staff provident fund—leaving £13,728 to be carried to the next accounts. The Chairman (Mr. W. T. Western) told the shareholders at the meeting that the shadow of the commercial crisis in the Argentine appeared to be passing away, or at any rate becoming lighter; and he thought an improvement would be seen in general business. For the first time, he believed, in the history of the Company there had been a drop in the number of customers. They could no longer report big increases in receipts; but the totals had been fully maintained, and notwithstanding the increased cost of materials the expenditure had been kept practically level.

A Third Pipe-Line from Vyrnwy.

At the meeting of the Liverpool City Council last Wednesday, the Water Committee recommended the preparation of a Bill for powers to enable a third instalment of water to be brought from Lake Vyrnwy. Mr. Alfred Gates moved, as an amendment, that the matter should stand over until the termination of the war. He agreed that at an early date it would be necessary to have a third pipe laid from Vyrnwy, but submitted that the present time was inopportune for undertaking the work. The scheme would cost possibly £1,000,000. Mr. Richard Hough seconded the amendment. Alderman Burges, in supporting the recommendation, said that if the Corporation obtained powers next year, they would not be able to start work until 1917. A difficulty might arise at any moment in regard to the bringing of water from Rivington to Liverpool. Mr. Max Muspratt complained that advantage was not taken of the opportunities for utilizing sea water for certain purposes. At present fresh water was, he submitted, being used wastefully. He did not oppose the recommendation, but he thought they ought seriously to look to the fact that they had at their doors a vast quantity of water which might be utilized. To use it would, of course, mean a double distribution of water in Liverpool; and at the present moment this was impossible. Sooner or later, however, it must be faced. Colonel Porter (the Chairman of the Water Committee) pointed out that the laying of the second pipe-line occupied more than three years. If the Corporation obtained their Act next year it might be the year 1920 before the work was finished. Unless the matter was taken in hand now, Liverpool would run considerable risk of being short of water. The Committee's recommendation was unanimously agreed to.

Price of Gas Raised at Stroud.—A notice to consumers has been issued by the Stroud Gas Company that, the cost of coal having risen since the outbreak of the war by over 20 per cent., and other materials used in connection with gas undertakings having gone up considerably, they are compelled to increase the price of gas 3d. per 1000 cubic feet. The cost is, therefore, now 3s. 3d. The price of coke at the gas-works has been increased to 16s. 8d. per ton. In December, the charge was 10s. per ton.

Gas Prices Increased at Lincoln.—With two dissentients, the Lincoln City Council, at their last meeting, adopted the recommendation of the Gas Committee to increase the price of gas from the midsummer quarter by 3d. per 1000 cublic feet, to 2s. 3d. Alderman Wallis explained that it was estimated that during the ensuing year coal would cost from £7000 to £8000 more, and that there would be an inability to obtain as much from the residual products as in the past. The increase of 3d. will not apply to consumers who use slot meters; but the usual discount of 12½ per cent. will not be allowed to them. Mr. Stephenson said he thought it was a most ridiculous position to give to the relief of rates £2500, and then have to come forward and ask the Council to raise the price of gas.

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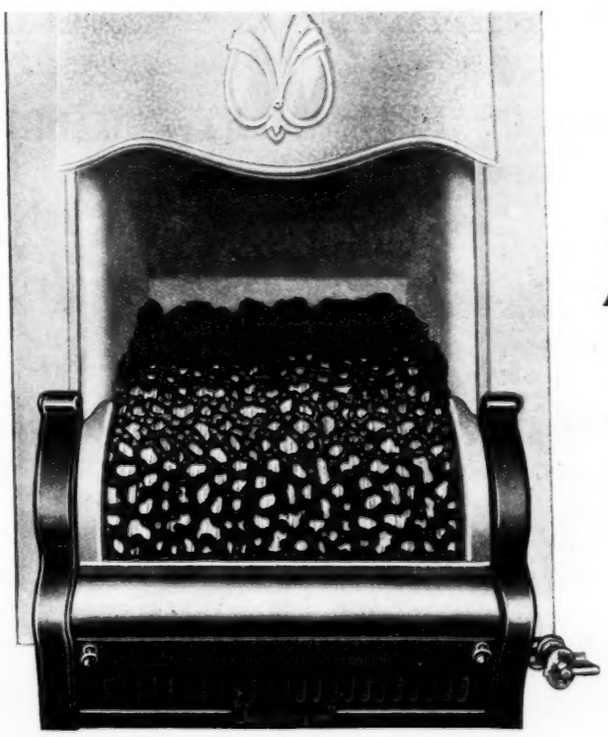

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CHEAPSIDE, E.C.

The Case of Murder by Gas.—The man Speerli who was, at the Birmingham Winter Assizes, found guilty of murdering his little daughter by means of gas, and sentenced to death (as recorded in the "JOURNAL" for March 23, p. 759), has had his sentence commuted to one of penal servitude for life. At the trial, the Jury strongly recommended him to mercy.

Holsworthy Gas and Electric Supply Company, Limited.—Presiding at the fifth annual meeting of the Company, Mr. Kivell said that, notwithstanding the increased price of coal, &c., the year had been very satisfactory. The net revenue from the gas undertaking for 1914, over the year 1913, amounted to £77. The Directors recommended a dividend of 4 per cent., being ½ per cent. higher than last year. The report and balance-sheet were adopted.

An Increased Price at Doncaster.—The Gas Committee reported to the Doncaster Town Council at their meeting last week that, having considered the present financial position of the department, they recommended that the price of gas for lighting and power purposes be advanced 4d. per 1000 cubic feet; that the price of gas supplied to the public lamps be increased from 50s. to 60s. per burner; and that the military be charged full price for gas consumed. It was also recommended that £3000 only be transferred from the funds of the department to the borough fund as the result of the year's working. These proposals were approved; but a suggested increase in the price of coke from 10s. 10d. to 12s. 6d. per ton was defeated.

Belfast Gas Poisoning Case.—A verdict of "Death from misadventure" was returned by a Belfast Coroner's Jury who had inquired into the circumstances relating to the death of Mrs. Annie Lovell, who resided in Upper Newtownards Road. Deceased's husband, an Inland Revenue officer, stated that on his return to the house late at night he did not see his wife, and assumed that she had gone to bed. As she did not call him next morning, he went to her room, and found it full of gas; the jet being turned on. Deceased was at the window fully dressed; and from her position he thought she had been trying to break the window to get air. The top of the gas-jet was very loose; and when turning off the gas deceased, in removing her hand, might have unconsciously turned it on again.

Gas Prices in Ireland.—At a meeting of the Coleraine Urban District Council, the Gas Committee reported that, in their opinion, the price of gas (3s 4d. per 1000 cubic feet) must be substantially raised as from the 1st inst.; the actual amount to be determined in June, when the yearly contracts are to be settled. The Limavady (co. Londonderry) Urban District Council have asked the Lighting Committee to consider the question of advancing the price of gas; it being stated that a tender for gas coal just received marked an advance of 10s. per ton over the last cargo received. The Ballymena Urban District Council have decided to raise the price of gas to 4s. 7d. per 1000 cubic feet. A special meeting of the Athlone Council has been called to consider a report of the Gas Committee recommending a substantial increase in the price of gas for public and private lighting and manufacturing purposes.

Bombay Gas Company, Limited.—In the report to be presented by the Directors of this Company at the ordinary general meeting on the 22nd inst., they state that in the past year there was an increase in the sale of gas, both to private consumers and for the public lamps; the additional revenue from this source being £2878. There was also a higher return to the extent of £1619 from residual products. The profit for the year was £23,064; and the amount available for distribution is £31,165. Deducting the interim dividend, and making an addition to the reserve fund, there is £21,979 left, out of which the Directors recommend a dividend of 4½ per cent., making 7½ per cent. for the year, and leaving £9379 to be carried forward.

Primitiva Gas Company of Buenos Ayres.—It was mentioned last week that, owing to the grave financial crisis in the Argentine Republic, and the effects of the war, the Directors are unable now to recommend a further dividend on the ordinary shares. The accounts for the year 1914 show a profit, including £43,905 brought forward, of £323,331, and after providing for debenture interest, depreciation on investments, &c., the preference dividend, and an interim dividend of 2½ per cent. on the ordinary shares, there remained an available balance of £61,970. The Directors recommend the transfer of £3000 to the pension fund and £35,000 to the Retiro works amortization account, leaving £23,970 to be carried forward. The net revenue of the Company, for the reasons already stated, decreased by £84,665.

Budleigh Salterton Gas Company.—The annual meeting of the Company was held on March 31. The report and accounts, which were adopted, showed that for the past year there was a profit of £636. The Directors recommended the payment of a dividend of 5 per cent. on the 600 £5 original ordinary shares. They had placed to profit and loss account the balance at the reserve account, and had transferred therefrom to capital account the sum of £1000. A contract had been entered into with Messrs. Willey and Co. for the construction of an additional holder. There had been a considerable increase in the amount of gas made during the year; but the Directors had been reluctantly compelled to increase the price 4d. per 1000 cubic feet. The Chairman (Mr. Alfred Perkins) referred to the loss by death during the year of the Secretary (Mr. A. H. Passmore.)

Tavistock Lighting Company.—The annual meeting of shareholders of the Tavistock Lighting Company was held last month, when the Directors' report was adopted. This mentioned the difficulties that had been experienced in obtaining coal, even at greatly increased prices, but added that it was gratifying to note that the sale of gas to private consumers had considerably increased—a large percentage of this increase being due to the automatic meter installations. The revenue account for the year showed a profit of £1317, and the balance to the credit of profit and loss, after payment of the interim dividend, was £1261. A final dividend was declared for the year at the rate of 4s. 7d. per share on the original capital, and 3s. 2½d. per share on the additional capital. Replying to a vote of thanks, the Manager (Mr. C. Stapleton) attributed a recent partial failure of the gas to the inferior quality of consignments of coal during the past few months.

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RADFORD ROAD, NOTTINGHAM.

Record Output in Birmingham.—From the "City of Birmingham Gas Department Magazine": On Saturday, March 20, 1915, a new record was made for Birmingham in the output of gas. On that date, the figure for the year 1914-15 passed the ten thousand millions—10,019,669,000, to be exact. This gigantic figure is exceeded by only two other gas undertakings. The Gas Light and Coke Company sent out last year nearly thirty thousand millions, and the South Metropolitan Company over fourteen thousand millions.

Birkenhead Gas Charge Raised.—Alderman J. H. M'Gaul (the Chairman of the Gas Committee) referring at last week's meeting of the Birkenhead Town Council to the necessity for increasing the price of gas from 2s. 3d. to 2s. 6d. per 1000 cubic feet, stated that it was brought about through the increased price of coal. Mr. Egan moved the resolution back; observing that the gas undertaking was not on the rates. It earned a good profit, and contributed a large sum in relief of the rates. Mr. Rowlands pointed out that if the price was not increased, the rates for the current year would be higher. The amendment was lost.

Dorking Gas Company.—At the half-yearly meeting of the Company, the Chairman (Mr. Herbert Young) stated that no rise in the price of gas was at present contemplated. The accounts presented showed, after providing for interest on the debenture stock, a balance available for distribution of £2242, and the Directors recommended the payment of dividends of 5 per cent. per annum on the "A," "B," "C," and "D" shares. This would absorb £1250, and leave a balance of £992 to be carried forward. The manufacturing results had, the report said, been satisfactory; but the contracts for coal had been adversely affected by the war.

War Bonus Granted at Manchester.—At the meeting of the Manchester City Council last Wednesday, after a keen discussion, interspersed with a variety of Labour amendments, a proposition of the Finance Committee was carried, which fixed the war bonus at 2s. per week for employees earning 28s. and less—the bonus not to bring the wages beyond 30s. per week. This is a great reduction from the original scheme, which recommended bonuses of 2s. per week to all employees of the Corporation who were in receipt of less than 40s. per week. There were no fewer than 1560 of these in the Gas Department alone; and the annual cost was estimated as being something like £7800.

Electric Motor Causes Serious Fire.—One of the most difficult tasks with which the Newcastle Fire Brigade have been confronted for some years was successfully accomplished last Thursday night, when, after three hours' hard work, they succeeded in mastering an outbreak of considerable dimensions at the premises of the Young Men's Christian Association in Blackett Street. The fire broke out in the top floor of the building, where there was an electric motor which worked the fans to clear the air in a café in the basement; and the occupant of a photographic studio on the ground floor, which sustained serious damage, expressed the opinion, as the result of first-hand knowledge, that the outbreak was caused by a defect in the motor.

Mr. W. Newbigging and the Grand Rapids Gas Supply.—According to the "American Gas Light Journal," the report of Mr. William Newbigging, who has been investigating the gas supply of Grand Rapids (Mich.), has been received by the city authorities. He states that the Gas Company can sell their product at 66·69 c. instead of 70 c., and make 8 per cent. profit. He estimates that new plant can be built for $3,400,000, which would be capable of making 1200 million cubic feet of gas per annum, which is 200 million cubic feet more than the Company's present output. An offer by the Company of 75 c. gas in return for a new twenty-year franchise has been rejected. The present rate is 80 c., and the franchise expires in 1920.

Llandudno Extension Scheme.—The Engineer and Manager of the Llandudno Gas-Works (Mr. Walter Shadbolt) has advised the Gas Committee that a remodelling of the works and substitution of through retorts for the present ones is necessary in order to give an adequate supply of gas for the town; but the attitude of the Local Government Board in regard to loans at the present time has led to the postponement of a portion of the scheme, which was estimated to cost about £6000. The Council have, however, decided to proceed with the conversion of the retort-bench, leaving the stoking machinery and coal-handling plant until a loan can be obtained. The cost of the work to be carried out at once is estimated at £2400; and it will be completed before next winter.

Lincoln Gas and Electricity Profits.—Upon the understanding that a further £500 was to be voted, if required by the Finance Committee, the Lincoln City Council, at their meeting last week, decided to allocate £2000 of the profits of the gas undertaking in relief of the rates. A protest emanated from Mr. Stephenson, who urged that the consumers ought to receive the benefits of the trading, and not the ratepayers generally. He contended, also, that the proposed arrangement would mainly benefit the landlords. It was decided at the same meeting to devote a sum from the profits of the electricity undertaking to the relief of municipal burdens; Alderman W. S. White (the Chairman of the Electricity Committee) stating that it had been one of the best years in the history of the undertaking.

Responsibility for Money in Meters.—The question as to whether a gas consumer is liable for money taken from a gas-meter by a person other than an agent of the gas company has been determined by the Supreme Court of Alabama in a case in which the highest Court upheld the following rule of the Appellate Court: "We are aware of no rule of law which would render invalid and unenforceable an undertaking of a consumer of gas to be responsible for the loss or theft of the money deposited in payment for it, while the money is in the agreed receptacle for it on his own premises. By such an undertaking he merely ensures the safety from violence or theft of the money deposited for gas as desired before it goes into the possession or under the control of the party entitled to it, and while it is in the agreed place of deposit on the premises served through the meter of which the consumer makes use. The law does not forbid the assumption of such risk by a consumer of gas who contracts for such a method of service."

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Incorporating Maughan's Patent Geyser Co. (Originators of Geysers).
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The Keith patent low-pressure domestic gas-iron is the subject of a coloured show-card which the James Keith and Blackman Company have just prepared for the use of those desirous of drawing public attention to its advantages. The iron is the result of prolonged experiment and experience, and is claimed to be free from sooting, smell, or noise. The average gas consumption for the 5-lb. iron is about 3 cubic feet per hour.

The new summer list just to hand from the Richmond Gas Stove and Meter Company, Limited, is yet another medium for increasing the sales of gas. Concise in its explanation of each apparatus, with clear details as to prices, &c., it is in every way a handy edition for the breast pocket of the inspector or the consumer. The two pages devoted to the management of the gas-cooker should prove of great assistance to gas undertakings in urging the economical use of gas. A conspicuous cover (made so by its individuality of design) tells plainly of the convenience and time and labour saving effected by the gas-cooker.

APPLICATIONS FOR LETTERS PATENT.

4828.—Key, J. T., and Spencer, E. S., "Controlling gas." March 29.
4841.—Keith, J. & G., "Gas-lamps." March 29.
4929.—Carpenter, H. A., Warner, A. W., and the Riter-Conley Manufacturing Company, "Pressure control for gas-benches." March 30.
4984.—Metropolitan Gas-Meters, Ltd., and Forster, J. D., "Indicating leakage in gas-meters." March 31.
5021.—Bergius, F., "Manufacture of liquid organic compounds from the products of distillation of coal." March 31.
5040.—Hislop, R. F. & G. R., jun., "Heating-furnaces." April 1.
5041.—Croswheller, W. W., "Recording percentage volumes of constituent gases." April 1.
5111.—Strachan and Henshaw, Ltd., and Sargent, T., "Discharge shoots." April 1.
5119.—Wilson, W. A., "Manufacture of radiants." April 3.

GAS COMPANIES IN THE STOCK EXCHANGE.

The condition of things on the Stock Exchange has still further improved—in fact, the House at its close last Saturday might be said to have had an almost happy week. The volume of business done made a gratifying increase; and on Friday it registered a record number of transactions on any one day since the re-opening. And the strengthening of the markets extended so as to embrace almost all classes, from the gilt-edged aristocrats down to the more humble members of the miscellaneous category. Oils and rubbers and metals, shipping and munitions and materials, were bright and active. Americans and Argentines were strong. Perhaps the only exception to the general mark was in Home Rails. The firmness lasted right up to the close; Saturday being quite a busy and buoyant day. The public seem to have plenty of confidence, undismayed by the "drink" question or rumours of difficulties between Holland and Germany. The Gas Market pursued the even tenor of its way, with about an average number of bargains done, and with no apparent change in prices, which generally maintained to the full the level of values previously indicated. No event of important significance affecting the prices of stocks was forthcoming. The Money Market was variable. In midweek a hardening tendency was apparent from a further issue of 15 millions of Treasury Bills. Discount houses advanced their deposit rates by ½ per cent. The tendency was easier at the close.

Bargains done for cash during the week were as follows: On Tuesday (when the Exchange re-opened after the Easter holidays), Alliance and Dublin 71½, 72, Gas Light ordinary 86½, 87, South Suburban 100, 100¾, Tottenham "B" 113, 113½. On Wednesday, Alliance and Dublin 71½, 71⅞, Aldershot preference 85½, 86, Gas Light ordinary 87, 87½, ditto maximum 71⅜, 71⅞. On Thursday, British 40¼, 40⅜, 41, Commercial 4 per cent. 98, ditto 3½ per cent. 95, Gas Light ordinary 96½, 97½, 98, ditto maximum 71½, 71⅝, 72, ditto debenture 69½, 70, Imperial Continental 82½, 83, South Metropolitan debenture 67½, 68, South Suburban 100, 100¾. On Friday, Commercial 3½ per cent. 95, Gas Light ordinary 96½, 95⅝, 97, 97¼, 97½, ditto maximum 72, ditto preference 85, ditto debenture 69¾, Primitiva preference 4½, 4 11/16, South Metropolitan 91½, 92¼, ditto debenture 67½, 68, Tottenham "B" 112, 112½, 113. On Saturday, Gas Light ordinary 96½, 97, 97¼, Oriental 110½, Primitiva preference 4¼, South Metropolitan debenture 67½, 68.

Bank rate (fixed Aug. 8), 5 per cent.; last year, 3 per cent.

LOWEST AND HIGHEST PRICES OF BARGAINS DONE FOR CASH IN THE WEEK ENDING APRIL 10.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p c.			£ s. d.	
1,551,968	Stk.	April 8	2½	Alliance & Dublin Ord.	59—64	3 18 2	71½—72
374,000	,,	July 10	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	Bombay, Ltd.	5¾—6¾	5 17 8	..
50,000	10	Feb. 26	16	Bournemouth Gas and Water — 10 p.c.	29—30	5 6 8	..
378,480	10	,,	7	Bournemouth Gas and Water — B 7 p.c.	15—15½	4 10 4	..
95,000	10	,,	6	Bournemouth Gas and Water — Pref. 6 p.c.	13½—14	4 5 9	..
—	—	—	—	Bournemouth Gas and Water — Deb.	..	—	..
380,000	Stk.	Feb. 26	14	Brentford Consolidated	261—266	5 5 3	..
330,000	,,	,,	11	Do. New	204—209	5 5 3	..
50,000	,,	,,	5	Do. 5 p.c. Pref.	109—111	4 10 1	..
206,250	,,	June 11	4	Do. 4 p.c. Deb.	91—93	4 6 0	..
217,380	Stk.	Feb. 26	11	Brighton & Hove Orig.	208—213	5 3 4	..
244,200	,,	,,	8	Do. A Ord. Stk.	154—159	5 0 8	..
530,000	20	Mar. 26	12½	British	44—45	5 11 1	40¼—41
120,000	Stk.	June 26	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	..
245,771	Stk.	June 26	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	Do. 4½ p.c. Pref.	4—6	—	..
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	Chester 5 p.c. Ord.	103—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	Commercial 4 p.c. Stk.	106—108	5 1 2	98
560,000	,,	,,	5½	Do. 3½ p.c. do.	103—105	5 1 6	95
475,000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 8 11	..
800 000	Stk.	,,	4	Continental Union, Ltd.	76—79	5 1 3	..
200 000	,,	,,	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
—	—	—	—	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	Derby Con. Stk.	123—125	4 16 0	..
55,000	,,	—	4	Do. Deb. Stk.	102—104	3 16 11	..
1,002,180	10	July 29	10	European, Ltd.	17½—18	5 11 1	..
16,362,910	Stk.	Feb. 12	4/17/4	Gas Light — 4 p.c. Ord.	98—102	4 15 6	86½—88
2,600,000	,,	,,	3½	Gas Light — 3½ p.c. max.	76—79	4 8 7	71⅜—72
4,062,235	,,	,,	4	Gas Light and Coke — 4 p.c. Con. Pref.	96—99	4 0 10	85
4,674,850	,,	June 11	3	Gas Light and Coke — 3 p.c. Con. Deb.	73½—74½	4 0 6	69½—70
258,740	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	Hongkong & China, Ltd.	16½—16⅝	6 11 4	..
—	—	—	—	Hornsey 7 p.c.	..	—	..
131,000	Stk.	Mar. 12	7⅛†	Ilford A and C	151—154	5 2 4	..
65,780	,,	,,	6⅜†	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	Do. 4 p.c. Deb.	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	Imperial Continental	150—160	5 12 6	82½ 83
1,235,000	Stk.	Feb. 12	8½	Do. 3½ p.c. Deb. Red.	84—86	4 1 5	..
200,342	Stk.	Mar. 12	6½	Lea Bridge Ord. 5 p.c.	119—121	5 7 6	..
661,000	Stk.	Feb. 26	10	Liverpool 5 p.c. Ord. — A	211—213	4 13 11	..
718,100	,,	,,	7	Liverpool 5 p.c. Ord. — B	146—148	4 14 7	..
306,083	,,	June 26	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices. July 30.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.			£ s. d.	
75,000	5	June 11	6	Malta & Mediterranean	4⅛—4⅜	6 9 9	..
250,000	100	April 1	4½	Met. of Melbourne — 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	Monte Video, Ltd.	11½—12	6 13 4	..
1,775,892	Stk.	July 29	4½	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	Do. 3½ p.c. Deb.	82—83	4 4 10	..
55,940	10	Feb. 26	7/14/0	North Middlesex 7 p.c.	14—16	5 2 8	..
300,000	Stk.	May 14	8	Oriental, Ltd.	117—122	6 11 2	110½
60,000	5	Mar. 26	10	Ottoman, Ltd.	7½—7⅝	6 9 0	..
60,000	50	Feb. 26	13	Portsea, Island B	128—131	4 19 3	..
100,000	50	,,	12	Do. C	118—121	4 19 2	..
249,980	5	April 29	8	Primitiva Ord.	5⅜—6	6 13 4	..
499,960	5	June 26	5	,, 5 p.c. Pref.	4¾—5	5 0 0	4½—4 2/16
521,600	100	June 2	4	,, 4 p.c. Deb.	91—93	4 6 0	..
—	—	—	—	,, ,, ,, 1911	..	—	..
346,198	Stk.	June 26	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	San Paulo — 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	San Paulo — 5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	Sheffield A	223—224	4 9 3	..
209,984	,,	,,	10	Do. B	223—224	4 9 3	..
523,500	,,	,,	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	South African	10½—11½	7 16 6	..
6,429,895	Stk.	Feb. 12	5/9/4	South Met., 4 p.c. Ord.	111—113	4 16 8	91⅛—92⅛
1,295,445	,,	July 10	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	67⅝—69
209,820	Stk.	Feb. 26	8½	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 6	100—100⅞
60,000	,,	,,	5	Do. 5 p.c. Pref.	110—112	4 9 3	..
—	—	—	—	Do. West Kent.	..	—	..
137,058	,,	June 26	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	Southampton Ord.	99—102	4 18 0	..
130,000	Stk.	Feb. 12	7½†	Tottenham — A 5 p.c.	135—138	5 8 8	..
742,275	,,	,,	6½†	Tottenham — B 3½ p.c.	115—117	5 2 7	112—113½
181,255	,,	June 26	4	Tottenham District — 4 p.c. Deb.	87—89	4 9 11	..
182,380	10	Dec. 30	5	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	Tynemouth, 5 p.c. max.	108½—109½	4 11 4	..
30,000	Stk.	Feb. 26	8⅜	Wandsworth, Wimbledon, and Epsom — Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6⅞	,, B 3½ p.c.	129—134	5 2 7	..
108,075	,,	,,	5/17/3	,, C 3½ p.c.	110—115	5 2 0	..
352,000	,,	,,	6½	Wimbledon 5 p.c.	117—122	5 0 5	..
96,000	,,	,,	6⅝	Epsom 5 p.c.	121—126	5 5 2	..
88,416	,,	June 26	3	3 p.c. Deb. Stk.	66—69	4 6 11	..

x Bargains marked thus were "Ex Div."

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Distribution Superintendent. Rochdale Gas Department. Applications by Apri 21.
Superintendent. Shipley Gas Depa tment. Applications by April 19.
Assistant Manager. Merthyr Tydfil Gas-Works. Applications by April 17.
Inspector (Gas Fitting, &c.). No. 6015.
Draughtsman. Cockey's, Frome.
Salesmen (Two). Portsea Island Gas Company. Applications by April 28.
Salesman. Bath Gas Company.
Fitter (Gas and Water). No. 6016.

Agency Required or Use of Office.

No. 189, c/o Willings, Strand.

Capital Required.

Gas Stove Business. No. 6017.

Gas-Works for Disposal. No. 6011.

Plant, &c. (Second-Hand), for Sale.

Gas-Works Plant and Appliances. Middlesbrough Corporation. Offers by April 19.
Retort Bench Ironwork, Governors, &c. Nottingham Gas Department.
Scrubber. John Adams and Sons, Newcastle-on-Tyne.

Patent Licences.

Carbide Supply Pistons. Haseltine, Lake, and Co., 28, Southampton Buildings, Chancery Lane, W.C.
Treating Coal for Coking. Haseltine, Lake, and Co., 28, Southampton Buildings, Chancery Lane, W.C.

Meeting.

Imperial Continental Gas Association. Cannon Street Hotel, May 4, 2.30 o'clock.

TENDERS FOR

Castings (Retort).

Leeds Gas Department. Tenders by April 24.

Meter (Station).

Darlington Gas Department. Tenders by April 22.

Purifiers.

Darlington Gas Department. Tenders by April 22.

Pipes.

Leeds Gas Department. Tenders by April 24.